

PROCEEDINGS
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The Academy of Natural Sciences
OF
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1938

THE ACADEMY OF NATURAL SCIENCES
OF
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1939

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THE PROCEEDINGS MAY BE PURCHASED AT THE FOLLOW-
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ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SOUTH PACIFIC
EXPEDITION, 1937. PART I,—GALAPAGOS MOLLUSCA

BY JEANNE SCHWENGEL.

In the course of the George Vanderbilt South Pacific Expedition¹ of 1937, mollusks were collected at Chatham Island, Galapagos, and at Christmas Island, and cephalopods, which will be reported on separately, in various other localities. The following list includes beach shells picked up by Mr. Ronald W. Smith at Wreck Bay, Chatham Island.

Tralia vanderbilti J. Schwengel
Williamia galapagana Dall
Bulla rufolabris A. Adams
Terebra variegata Gray
Conus lucidus Mawe
Conus nux Broderip
Cancellaria haemastoma Sowerby
Oliva kaleontina Duclos (?)
Olivella anazora Duclos
Marginella phrygia Sowerby
Marginella minor C. B. Adams
Marginella rosa J. Schwengel
Mitra tristis Swainson
Mitra gratiosa Reeve
Mitra crenata Broderip
Crassispira splendidula Sowerby
Latirus varicosus Reeve
Latirus tuberculatus Broderip
Tritonidea sp.
Engina pyrostoma Sowerby

Nassa nodicincta A. Adams
Columbella fuscata Sowerby
Columbella castanea Sowerby
Columbella haemastoma Sowerby
Columbella atramentaria Sowerby
Anachis incerta Stearns
Anachis suffusa Sowerby
Mitrella cribraria guttata Sowerby
Murex radicans Hinds
Tritonalia erosa Broderip
Tritonalia lappa Broderip
Aspella pyramidalis Broderip
Thais planospira L.
Thais columellaris Lamarek
Coralliophila californica A. Adams
Cantharus sanguinolenta Duclos
Cantharus cinis Reeve
Cymatium lineatum Broderip
Cymatium wiegmanni Anton
Oniscia tuberculosa Sowerby

¹ An itinerary of the expedition will appear in a subsequent part of the Zoological Results.

- Trivia rubescens* Gray
Cypraea nigropunctata Gray
Strombus granulatus Gray
Cerithium adustum Kiener
Vermetus squamigerus Carp.
Vermetus pellucidus Broderip & Sowerby
Rissoina inca d'Orbigny
Littorina aspera Philippi
Littorina aspera conspersa Philippi
Cheilea varia Broderip
Amalthea tumens Carpenter
Amalthea pilosa Desh.
Crepidula aculeata Gmelin
Crepidula nivea Ad.
Crepidula nummaria Gld.
Mamma uber Valene.
Eunaticina sp.
Opalia sp.
Tegula occulta Philippi (?)
Tegula cooksoni Smith
- Phasianella phasianella* C. B. Adams
Nerita scabricosta Lamarek
Nerita fulgurans Gmelin
Fissurella macrostoma Sowerby
Diadora inequalis Sowerby
Acmaea fascicularis Menke
Acmaea mitella Menke
Chiton sulcatus Wood
Chiton goodalli Broderip
Ostrea sp.
Pedalion legumen Gmelin
Arca velata Sowerby
Arca solida Broderip & Sowerby
Codakia punctata Linnaeus
Codakia galapagana Dall
Tellina scobinata Linnaeus
Divaricella lucasana Dall & Ochs.
 (Lucina eburnea Reeve, f. 49, not of Desh.)

Descriptions of new species

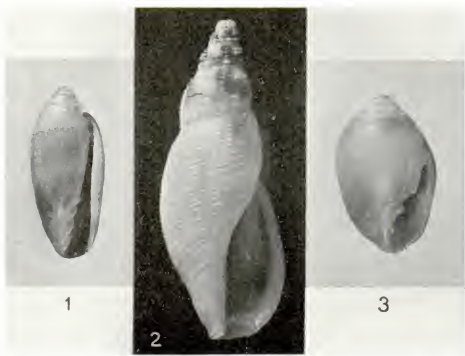


Fig. 1, *Marginella rosa*. Fig. 2, *Daphnella thalia*.
 Fig. 3, *Tralia vanderbilti*.

Daphnella thalia, new species. Fig. 2.

This species is rather lengthened and graceful, a little more slender than *Eudaphne allemani* Bartsch. White, clouded with cinnamon buff on the penultimate and last whorls, earlier whorls pinkish vinaceous, clouded with

cinnamon. Embryonic whorls lost. The following whorls are sculptured with rounded axial folds about equal to their intervals, becoming weaker and somewhat irregular on the last whorl, where they do not extend upon the base. These are crossed by strong spiral threads, of which there are fourteen at the end of the penult whorl, nine on the preceding whorl and five on the next earlier whorl. The sutural fasciole is rather narrow and sculptured with close, backwardly curved threads. The aperture is about half the total length, somewhat dilated in the lower part. The outer lip moderately thickened within, retracted at the base and above. Inner lip rather weakly concave. Columella straight.

Length 15.3 mm.; diam. 5.8 mm.

This beautiful species differs from *Eudaphne allemani* Bartsch in the details of its sculpture and color, as well as being of more slender shape. Type 170297 A.N.S.P.

Marginella rosa, new species. Fig. 1.

This species closely resembles *M. avena* Val., but it is smaller and more tapering toward the base, which is distinctly oblique. The color is pale pink with three broad darker bands with indefinite edges, between vinaceous and deep vinaceous in color. These bands are continuous, not interrupted into spots as in *M. avena*. Aperture about as in *M. avena*. Columella with four equal folds.

Length 8.1 mm.; diam. 3.6 mm.

In *M. californica* Tomlin the spire is much shorter and the color different. Possibly this is the species recorded by Wimmer as *M. rubella* C. B. Adams, but I have compared the type of *M. rubella* and find that it is a decidedly stouter shell, with shorter spire. It is about ninety years since Adams collected these shells and the color has almost entirely faded.

Many specimens were taken, but most of them are beach worn. Type 170298 A.N.S.P.

Tralia vanderbilti, new species. Fig. 3.

A species resembling *T. pusilla* (Gmelin), from which it differs chiefly by being shorter and broader. The two specimens are beach shells and somewhat faded. The freshest one is cinnamon buff, darker near the suture. The surface is smooth, except that the spire has closely engraved spiral lines, similar to those of *T. pusilla*. The aperture is similar to that of *T. pusilla*, having three strong folds on the columellar side and an entering, descending ridge within the outer lip.

Length 8.5 mm., diam. 5.7 mm.

Tralia panamensis C. B. Adams has been reported from Hood and Charles Islands by Wimmer (quoted by R. E. C. Stearns, Proc. U. S. Nat. Mus. 1893, Vol. 16, p. 429), but this is a very much more slender species. The closest relationship seems to be with the West Indian *Tralia pusilla* Type 170299 A.N.S.P.

**ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT AFRICAN
EXPEDITION, 1934. PART IX,—THE NEUROPTEROID INSECTS**

BY NATHAN BANKS.

The collection contains one fine new species, an ascalaphid, and a number of other interesting records; upon several of these I have made notes. Of especial interest is the new ascalaphid, *Phalascusa*. Specimens of this genus are uncommon, and nearly all have been described from one specimen, and there are few records of their occurrence. The general itinerary of the expedition and information on the chief collecting stations will be found in Part I of this series.¹

PERLIDAE

***Neoperla dubia* Klap.**

One male and two females from Saidi's Village, 10 miles west of Epulu River Ferry, Kibali-Ituri district, Belgian Congo, elev. 2800 feet, Sept. 13.

The male has the characteristic genitalia figured by Klapalek, the basal processes, and the very long and slender processes from the tenth segment. The ocelli in the dried specimens are nearer to each other than to the eyes, but plainly further apart than in *N. africana*. The female is much larger, 34 mm. expanse. This is quite possibly the female described by Navas as *N. leopoldina*; his specimen had no abdomen nor antennae. The antennae beyond the first joint are black; the abdomen is pale yellowish, the ventral plate projects only in broad, low, rounded piece about one-third the width of the segment. The cerci are pale yellowish as the abdomen, and tibiae of legs are dark above. The lateral boss of the head is a little nearer to the eye than to an ocellus, and is elliptical in shape, and fairly large.



Fig. 1. Ventral plate of female *Neoperla dubia* Klap.

BEROTHIDAE

***Berotha sashilana* Navas.**

One from Batangafo, Ubangi-Shari, French Equatorial Africa, Dec. 12 to 13. A very fine little species, described from Sashila, Belgian Congo.

¹ Proc. Acad. Nat. Sci. Phila., LXXXVIII, pp. 1-14, (1936).

MICROMIIDAE (Hemerobiidae)***Annandalia jeanneli* Navas.**

One specimen from Maji ya Moto, Molo River, between Rongai and Lake Hannington, elev. 3250 feet, Kenya, June 18. It was described from Rurunga, Kilkuyu, 1,550 meters, Kenya. This specimen has the wings rather longer than the Navas figure, but it shows the very broad costal area at base, the dark lines across apical part of wing, and the cross-veins agree; the palpi are dark.

CHRYSOPIDAE***Chrysopa congrua* Walk.**

One specimen of this widely spread species from Saidi's Village, 10 m. west of Epulu River Ferry, Kibali-Ituri District, Belgian Congo, elev. 2800 feet, Sept. 13.

***Chrysopa umbrosa* Navas.**

Two specimens from West side Mt. Kenya above Naromoru, elev. 7800 feet, Kenya, July 12, and Kijabe section, Kikuyu Escarpment, elev. 8200 feet, Kenya, June 23; both are topotypes.

There are seven cubital cross-veins beyond the divisory veinlet, the second and third cubital cells are long, and post-cubital area is two and a half times as broad as the cubital.

***Glenochrysa nimbosa* Banks.**

One from Kitale, Lake Victoria, Entebbe District, Uganda, August 12.

There are three other African species in this genus: *G. conradina* Navas (1910), in which the stigmal spot is long and nearly black, the subapical spots in hind wing large and connected, and very few of the veins in front wing margined with the yellow brown; *G. principissa* Navas (1915) has two slender dark stripes on vertex, and continued back on pronotum, the basal antennal joint has two dark lines and there are differences in spots of fore wings; *G. typica* Petersen (1912) is near to *G. nimbosa*, but darker, and with fewer veins margined with the yellowish, and the stigmal spot is black. In *G. nimbosa* Banks (1918) the vertex has a median dark spot, the basal joint of antennae has three dark lines, the pronotum has a large dark spot each side in front part and behind a large spot in posterior corner; the stigma is yellowish, and with only some small dark spots. The basal costal mark in all four species is practically the same, and marks on hind wings nearly same, but larger in *G. conradina*. *G. nimbosa* occurs in Ubangi-Chari-Chad; near Cape Verde, West Africa, and now in Uganda.

Nothochrysa variegata Burm.

One from Kasenyi, Lake Albert, Belgian Congo, elev. 2100 feet, August 27. Widely distributed in Africa.

Ankylopteryx polystica Navas.

From West side of Mt. Kenya, above Naromoru, elev. 7800 feet, Kenya, July 13.

The face markings are characteristic, a median triangular spot, and a lunule each side below the antenna, also a small spot each side on clypeus. Basal joint of antenna with a brown stripe on outer side. The ends of some costals near base are dark; five cross-veins beyond the divisory cell.

Ankylopteryx nepheloptera Navas.

Two: from west side of Mt. Kenya, above Naromoru, elev. 7800 feet, Kenya, July 13; and Saidi's Village, 10 miles west of Epulu River Ferry, Irumu-Avakubi Road, Kibali-Ituri district, Belgian Congo, elev. 2800 feet, Sept. 13.

This species also has five cross-veins beyond the divisory cell.

MYRMELEONIDAE**Palpares tigris** Dahl.

One from Gounguru, 15 miles north of Nola, Middle Congo, French Equatorial Africa, Nov. 6.

Palpares interioris Kolbe.

Several from Maji ya Moto, Molo River between Rongai and Lake Hannington, elev. 3250 feet, Kenya, June 18 (at light). Esben-Petersen considers this the same as the more northern *P. papilionoides*.

Gama nubifer Kolbe.

From Kasenyi, Lake Albert, Belgian Congo, elev. 2100 feet, Aug. 27; and Njana Farm near Tinda Bridge, Region of Bunia, Kibali-Ituri District, Belgian Congo, elev. 3500 feet, Aug. 31.

Gama limpida Kolbe.

Several from Kasenyi, Lake Albert, Belgian Congo, elev. 2100 feet, Aug. 22-23; and Athi River crossing 16 miles N. N. E. of Kibwezi, Kenya, elev. 1400 feet, July 25.

Gama decussata Navas.

From Gisi River, Kiu Hills, between Machakos and Emali, Kenya, elev. 3375 feet, July 29.

Gama aegyptiaca Rbr.

One from Kiboko, S.W. of Simba, Kenya, July 28 (at light).

Gama mortifer Walk.

One from Maja ya Moto, Molo River between Rongai and Lake Hannington, Kenya, elev. 3250 feet, June 16.

Cueta mysteriosa Gerst.

Several from Maja ya Moto, Molo River between Rongai and Lake Hannington, Kenya, elev. 3250 feet, June 18. Widely spread in tropical Africa.

ASCALAPHIDAE**Phalascusa aequalis**, sp. nov.

Head pale with yellowish brown hair, vertex with darker hair; antennae yellowish, tips brown; thorax mostly brown, with yellow spots, anterior lobe with a yellow mark each side toward middle, continued back on lateral lobes, extreme side of this lobe pale, lateral lobes pale above wings; meso-scutellum yellow, with a brown cruciate mark; a pale spot above base of each hind wing; metascutellum yellow, with a median brown stripe, posterior slope of metanotum with two pale marks converging behind; pleura with a few pale spots. Abdomen rich brown, with a row of yellow spots each side; each segment above rather pale red brown, with median black stripe and two yellow spots at hind margin; venter pale; legs pale, femora more reddish, hair black.



Fig. 2. *Phalascusa aequalis*, sp. nov. Type.

Wings plainly tinted with yellowish, the costa, subcosta, and radius still more clearly yellowish, other veins pale, cross-veins often partly dark; stigma pale yellow covering four veinlets, plainly longer than high, in both wings a fairly large subequal brown spot extending up on basal costal veinlets, much as in *P. pardalis*.

Fore wings much as in other species; five cross-veins before radial sector, apical area with two cell-rows, three internal and five external, besides the apical; thirteen radial before the one near the stigma.

Hind wings not widened behind near middle, three cross-veins before the radial sector.

Length of fore wing 27 mm., width 8 mm.

Length of hind wing 22 mm., width 6.5 mm.

One from Ekibondo's Village, between Niangara and Dungu, Uele, Belgian Congo, elev. 2650 feet, Oct. 1.

It can be placed in the following table:

- | | |
|--|---|
| 1. With dark in hind wing extending about to middle | 2 |
| Dark only near base | 3 |
| 2. No dark at base in hind wings, but a large spot at middle; hind wings not triangular | <i>cruciger</i> |
| Dark at base, separated from the large spot in middle by a narrow pale area; hind wings more triangular .. | <i>pardalis</i> , <i>hildebrandti</i> and <i>patrizii</i> |
| 3. No dark at base of hind wing, veins very dark | <i>vassei</i> |
| Dark spot at base of hind wings | 4 |
| 4. Spots at base of fore wing very much larger than in hind wing, wings hyaline | 5 |
| Spots at base of fore and hind wings subequal, wings yellowish .. | <i>aequalis</i> |
| 5. Hind wing shorter, more triangular | <i>similis</i> |
| Hind wing longer, not widened behind in middle | <i>braueri</i> |

Helicomitus festivus Rbr.

One from Ekibondo's Village, between Nianga and Dungu, Uele, Belgian Congo, elev. 2650 feet, Oct. 3. A common African species.

HYDROPSYCHIDAE

Dipseudopsis fasciata Brauer.

Several from Lake Baringo near mouth of Molo River, Kenya, elev. 3150 feet, June 19 (at light). Common in tropical Africa.

Dipseudopsis sp.

One female from Butiaba, Lake Albert, Unyoro, Uganda, elev. 2080 feet, Aug. 29. May possibly be *D. centralis* Kolbe.

Ecnomus sp.

One from Lake Baringo near mouth of Molo River, Kenya, elev. 3150 feet, June 19 (at light). In poor condition.

A NEW CLUB-FLOWER FROM NEVADA

BY FRANCIS W. PENNELL.

The intensive botanical exploration of the Charleston Mountains in southern Nevada shows that this isolated highland supports yet another endemic species of the family Scrophulariaceae.¹ This is a species of Club-flower or *Cordylanthus* of which Mr. Ira W. Clokey has collected an ample series. It may be described as follows:

Cordylanthus glandulosus Pennell & Clokey.

Annual. Tap root yellow. Herbage glandular-pubescent, the glands yellow. Stem 1.5-3.5 dm. tall, much branched, the branches ascending, glandular-hirsute throughout. Leaves green or somewhat purplish, densely glandular-pubescent: the lowermost broadly linear (2 mm. wide), obtuse; those of the main-stem mostly trifid, 1.5-2.5 cm. long, the divaricate lateral lobes somewhat shorter, all lobes obtuse, about 1 mm. wide, the wider united base 2-5 mm. long; those of the branches smaller, shorter-lobed or entire. Head-like inflorescences terminating the stem and branches, although some may appear axillary due to subsequent development of lateral branches; clusters containing from 1 to 6 flowers. Involucral bracts 2 or 3, with 3 to 5 linear lobes. Subtending calyx-like bract 11-12 mm. long, entire, 3-ribbed, white-ciliate, the tip decurved and rounded. Calyx slightly longer, 12-13 mm. long, not ciliate, at apex bifid-notched, the lobes 0.5-2.0 mm. long, acute or obtuse. Both calyx and calyx-like bract dull green or violet-purplish, proximally white-hirtous, distally minutely glandular-pubescent. Corolla 14-15 mm. long; tube narrow, yellow; throat inflated, widely expanded horizontally and somewhat trisaccate beneath, violet-purple posterior lip sagittally narrow, distally pale yellow, glabrous like the posterior side of the throat, the distal side of the apex hooded; anterior lip slightly shorter than galea, broadly tapering to an everted bright yellow tip, its lower (outer) surface proximally violet-purple and white-pubescent like the anterior side of the throat. Stamens 4, didynamous, the flattened filaments ciliate. Anthers 2-celled, yellow, each ciliate. Stigma protruding down from hooded apex of galea. Capsule about 7-8 mm. long, glabrous. Seeds 1-1.5 mm. long, brownish, the testa finely alveolate-reticulate with white lines.

(Annuus; caulis 1.5-3.5 dm. altus pilis glandiferis obsitus; folia glandulosa, imis linearibus integerrimis, caeteris trifidis; bracteae calycibus similes, 11-12 mm. longae, apicibus bifidae; corolla 14-15 mm. longa, galea

¹ Previously described endemics are *Synthyris ranunculina* Pennell, in Proc. Acad. Nat. Sci. Phila. 85: 92, 1933; *Penstemon thompsoniae jaegeri* Keck, in Bull. Torrey Bot. Club 64: 362, 1937; *P. keckii* Clokey, in Madroño 4: 128, 1938; and *Castilleja clokeyi* Pennell, l.c. 89: 420, Ja. 1938. The earlier supposed endemic, *Penstemon aboriginorum* Jones, 1912 (*P. calcareus* Jones, 1908, not Brandegee, 1903), has recently been shown to be identical with *P. petiolatus* Brandegee, 1899, from Sheep Mt., Nevada; see Keck in Amer. Midl. Nat. 18: 774, 1937.

angusta distaliter flava, labio inferiore saccato violaceo-purpureo apice luteo; antherae biloculicidae; capsula 7-8 mm. longa; semina 1-1.5 mm. longa.)

Type, brushy hills, juniper belt, alt. 2270 meters, Harris Spring Road, Charleston Mountains, Clark County, Nevada, collected in flower and commencing to fruit July 16, 1937 by I. W. Clokey, no. 7715; in herbarium of Ira W. Clokey at the Los Angeles Museum; isotype at Academy of Natural Sciences of Philadelphia.

In R. S. Ferris' "Taxonomy and Distribution of *Adenostegia*"² the present species would trace by key to *A. parviflora* Ferris described from the vicinity of the Grand Canyon and of the San Francisco Mountains of northern Arizona. That plant would seem to differ, however, by its shorter pubescence ("pubescent and minutely viscid-pilose"), the outer involueral bracts merely trifid and with lobes but little longer than the widened basal portion, the subtending calyx-like bract exceeding the true calyx, the corolla smaller, only 10-11 mm. long, and the capsule narrowly conic. The photograph indicates a less virgate and less foliose habit than our plant shows. While the brief description does not mention several features on which I should like to have information, these details are sufficient to prove the distinctness of the present species. Its more exact relationship awaits a new study of the genus.

In his careful study of *Adenostegia eremica* Coville and Morton³ Mr. C. V. Morton has given the true explanation of the formation of the calyx in this genus. Over ten years earlier I had similarly interpreted the structure, the key to sections in my manuscript account prepared for a continuation of the "Scrophulariaceae of the Central Rocky Mountain States"⁴ contrasting *Chloropyron* having "calyx well-developed, obviously surrounding the tube of the corolla," with *Euadenostegia* and *Anisocheila* having "calyx apparently only on the posterior side of the corolla (which it nearly surrounds at base)" and the subtending bract calyx-like. Earlier workers had described the calyx as "monophyllous" or "diphyllous", in the latter case mistakenly associating this bract with the true calyx. Such an interpretation, as given in Gray's "Synoptical Flora"⁵ and other works, called for a horizontal cleavage between upper and lower sepals quite at variance with that prevalent in the tribe *Euphrasieae*. Morton's and my

² Bull. Torrey Bot. Club 45: 399-423, pl. 10-12, 1918. *Adenostegia* Benth. (1836) has priority over *Cordylanthus* Nutt. (1846), but the latter name was preferred by Bentham himself and has been made a *nomen conservandum*.

³ Jour. Washington Acad. Sci. 22: 160-166, 1932.

⁴ This manuscript, covering the genera not treated in Contrib. United States Nat. Herb. 20: 313-381, 1920, has remained unpublished because of my desire to reconsider *Castilleja* after further field study.

⁵ 2. pt. 1: 303, 1878.

interpretation alligns the calyx closely with that of *Orthocarpus* and *Castilleja*. In both these genera the posterior sepal has long been lost, then in the latter there is a progressive tendency to the fusion of the lateral sepals or calyx-lobes. Let these unite to apex; then let the resultant lateral calycine structures join posteriorly so that merely the tips remain distinct, and one has the evolutionary history of the calyx of *Cordylanthus*. It is a remarkable development that ultimately presents a narrow calyx nearly wholly posterior to the flower, yet in which the true posterior sepal is actually unrepresented.

**THE OCCURRENCE OF FLINTS AND EXTINCT ANIMALS IN PLUVIAL
DEPOSITS NEAR CLOVIS, NEW MEXICO. PART V,—DIATOM
EVIDENCE FROM THE MAMMOTH PIT**

BY RUTH PATRICK.

INTRODUCTION

This study of the diatoms of Mammoth Pit is based upon samples obtained from the geological excavations made by Dr. Edgar Howard during the summer of 1936. This geological work is a continuation of the study which was started in 1933 of the artifacts and fossil remains of this region. At that time most of the work was done in a gravel pit which had been made by a road construction company. This pit is situated in Blackwater Draw between Clovis and Portales, New Mexico. The exact location is the southwest quarter of Section 25, Township 1 N, Range 34 E. In order to get a clearer idea of the stratigraphy of the region a new excavation was made which was named Mammoth Pit. It is located at the southwest corner of the gravel pit.

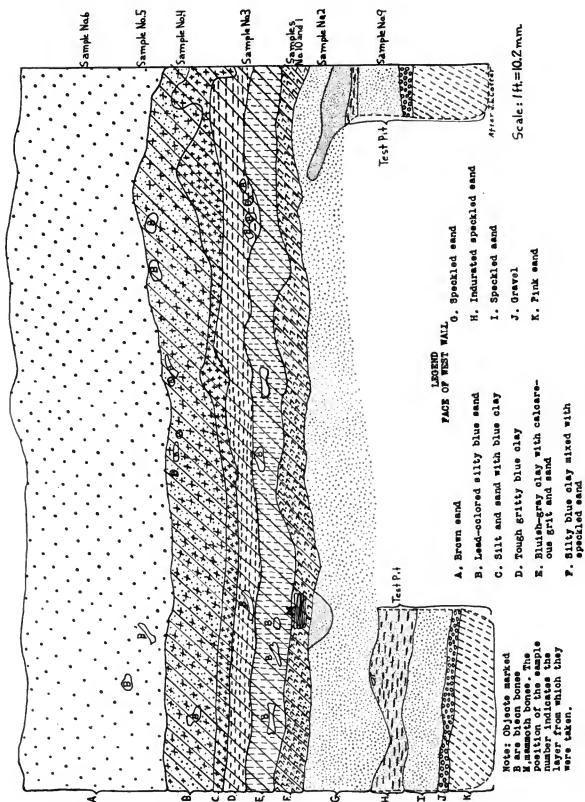
The stratigraphy (Cotter 1936) as shown by Mammoth Pit seems to divide itself into several strata; the top being a brownish dune sand which is about two and a half feet thick, a bluish material consisting of sand, grit and clay which is about three feet thick, a speckled sand which varies from one and a half to seven feet in thickness, and below this a layer of coarse gravel of undetermined thickness. These layers are further subdivided as shown in Text-plate. It is in the bluish clay and speckled sand that most of the fossils are found. It is interesting to note that analyses of these two strata (Cotter 1936) demonstrate that the blue clay contains much of the speckled sand. The difference in color is to some extent due to the addition of carbonized vegetable matter.

METHODS AND PROCEDURE

Samples were collected from the various layers, as indicated in the Text-plate, by Dr. Edgar B. Howard and submitted to the author for study of the diatoms present. The author wishes to express her appreciation to Dr. Edgar B. Howard, Dr. Francis Drouet and to Prof. Ivey F. Lewis for their helpful advice and criticism during the progress of this paper.

Each sample was cleaned and examined separately, extreme care being taken that no contamination occurred between the samples or with foreign material. Permanent slides were made in hyrax mounts. The samples on which this paper is based are the property of the Academy of Natural

Sciences of Philadelphia. Study slides have been deposited in the herbarium of this institution and also in the author's private herbarium. Each sample is recorded under the collector's number. The numbers in parentheses indi-



cate the numbers of the slides in the author's collection. The samples are listed in succession as they progress from the bottom to the top of the excavation.

- Sample No. 9. Yellow sand from the lowest part of the speckled sand. (Nos. 3101-3109)
- Sample No. 2. Speckled sand from below blue clay. (Nos. 3111-18)
- Sample No. 10. Lowest part of blue clay. Specimens taken from near mammoth bones. (Nos. 3121-3130)
- Sample No. 1. Bluish sandy silt from about lower jaw of mammoth. (Nos. 3131-3140)
- Sample No. 3. Bluish gray silt, middle level where bison bones were thickest. (Nos. 3141-3150)
- Sample No. 4. Bluish sandy silt, top of blue clay layer. (Nos. 3151-3158)
- Sample No. 5. Lowest part of brown dune sand. (Nos. 3161-3166)
- Sample No. 6. Middle part of brown dune sand. (Nos. 3171-3180)

In the following table a series of letters is used to represent the relative abundance of a species throughout the various strata; A is abundant, C is common, F is frequent, and R is rare. The relative abundance of the diatoms within a given layer is discussed at the end of the paper. Only those species are discussed which occur in sufficient numbers to make up a considerable part of the association. In many cases, particularly in rare forms, the R, as well as indicating the distribution of a species from layer to layer, coincides with its abundance as compared with other species within a single layer. However, it must be remembered that the letter primarily represents the distribution of the species from layer to layer and only secondarily is for comparison between species in a given layer.

The column labeled habitat indicates the type of water in which a species is usually found: F is fresh, B is brackish, M is marine, and E is euryhaline.

	Sample No.	6	5	4	3	1	10	2	9	Habitat
	Stratum	A	A	B	D	F	F	G	I	
<i>Achnanthes exigua</i> Grun.		—	—	—	R	—	R	—	—	F
<i>A. lanceolata</i> (Bréb.) Grun.		—	—	—	F	R	R	R	—	F
<i>A. lanceolata</i> v. <i>elliptica</i> Cl.		—	—	—	—	—	—	R	—	F
<i>A. linearis</i> (W. Sm.) Grun.		—	—	—	R	—	—	—	—	F
<i>Amphora ovalis</i> Kütz.		—	—	R	R	F	R	C	—	F
<i>A. ovalis</i> v. <i>pediculus</i> (Kütz.) V. H.		—	—	—	—	—	—	A	—	F B
<i>A. veneta</i> Kütz.		—	—	R	—	—	—	—	—	F B
<i>Anomoeoneis sphaerophora</i> (Kütz.) Pfitz. ...		—	—	F	F	—	—	C	—	F B
<i>A. sphaerophora</i> v. <i>sculpta</i> (Ehr.) Müll.		—	—	—	—	—	—	R	—	F B
<i>Caloneis bacillum</i> (Ehr.) Cl.		—	—	R	—	—	R	—	—	F B
<i>C. silicula</i> (Ehr.) Cl.		—	—	—	R	—	R	R	—	F
<i>C. trinoidis</i> (Lewis) Boyer		—	—	—	—	—	R	R	—	F B
<i>Cocconeis disculus</i> (Schum.) Cl.		—	—	—	—	—	F	C	—	F B
<i>C. placentula</i> Ehr.		—	—	—	F	R	F	F	—	E
<i>C. placentula</i> v. <i>euglypta</i> Ehr.		—	—	R	R	—	R	R	—	F
cf. <i>C. thumensis</i> Mayer		—	—	—	—	—	A	—	—	F

	Sample No.	6	5	4	3	1	10	2	9	Habitat
	Stratum	A	A	B	D	F	F	G	I	
<i>Cyclotella Meneghiana</i> Kütz.		—	—	—	—	F	—	—	—	F B
<i>C. striata</i> (Kütz.) Grun.		—	—	—	R	R	—	R	—	B M
<i>Cymatopleura solea</i> (Bréb.) W. Sm.		—	—	—	—	F	R	—	—	F
<i>C. elliptica</i> (Bréb.) W. Sm.		—	—	—	—	—	—	R	—	F B
<i>Cymbella affinis</i> Kütz.		—	—	—	—	R	C	—	—	F
<i>C. amphicephala</i> Naeg.		—	—	—	—	R	—	—	—	F
<i>C. aspera</i> (Ehr.) Cl.		—	—	R	R	F	—	F	—	F
<i>C. austriaca</i> Grun.		—	—	—	—	—	—	R	—	F
<i>C. cistula</i> (Hemp.) Kirchn.		—	—	—	C	C	A	F	—	F B
<i>C. cymbiformis</i> (Kütz.) Bréb.		—	—	—	—	R	F	F	—	F
<i>C. delicatula</i> Kütz.		—	—	—	—	—	C	F	—	F
<i>C. Ehrenbergii</i> Kütz.		—	—	—	—	R	C	R	—	F
<i>C. helvetica</i> Kütz.		—	—	—	—	—	—	R	—	F
<i>C. lanceolata</i> (Ehr.) Kirchn.		—	—	—	R	R	F	—	—	F B
<i>C. leptoceras</i> (Ehr.) Rabh.		—	—	—	—	F	R	R	—	F
<i>C. microcephala</i> Grun.		—	—	—	—	—	F	—	—	F
<i>C. parva</i> (W. Sm.) Cl.		—	—	—	—	F	—	—	—	F
<i>C. triangulum</i> v. <i>gracilis</i> Hustedt		—	—	—	—	—	—	R	—	F
<i>C. tumida</i> (Bréb.) V. H.		—	—	—	—	—	—	R	—	F
<i>C. turgida</i> Greg.		—	—	—	—	—	F	—	—	F
<i>C. ventricosa</i> Agardh		—	—	F	F	F	A	F	—	F B
<i>Denticula elegans</i> Kütz.		R	—	C	F	—	—	—	—	F
<i>D. elegans</i> v. <i>Kittoniana</i> Grun.		—	—	C	F	—	—	R	—	F
<i>D. lauta</i> Bail.		—	—	—	R	—	—	—	—	F
<i>D. tenuis</i> Kütz.		—	—	—	R	—	—	—	—	F
<i>D. tenuis</i> v. <i>inflata</i> (W. Sm.) Grun.		—	—	—	—	—	—	R	—	F
<i>D. tenuis</i> v. <i>intermedia</i> Grun.		—	—	—	—	—	—	R	—	F
<i>D. thermalis</i> Kütz.		—	—	—	R	—	—	—	—	F
<i>Diploneis elliptica</i> (Kütz.) Cl.		—	—	C	F	—	—	—	—	F B
<i>D. ovalis</i> (Hilse) Cl.		R	—	F	—	—	R	F	—	F B
<i>D. ovalis</i> v. <i>oblongella</i> (Naeg.) Cl.		—	—	—	—	R	—	—	—	F B
<i>Epithemia argus</i> Kütz.		—	—	C	—	F	—	R	—	E
<i>E. argus</i> v. <i>alpestris</i> (W. Sm.) Grun.		—	—	A	—	R	—	—	—	E
<i>E. Muelleri</i> Fricke		—	—	F	R	—	—	—	—	F
<i>E. musculus</i> Kütz.		—	—	R	—	—	—	—	—	B M
<i>E. turgida</i> (Ehr.) Kütz.		—	—	—	F	—	R	F	—	E
<i>E. turgida</i> v. <i>granulata</i> (Ehr.) Brun.		—	—	—	—	—	—	R	—	E
<i>E. turgida</i> v. <i>vertagus</i> (Kütz.) Grun.		—	—	R	—	R	—	—	—	F
<i>E. Zebra</i> (Ehr.) Kütz.		—	—	F	F	—	—	—	—	F B
<i>E. Zebra</i> v. <i>porcellus</i> (Kütz.) Grun.		—	—	—	F	—	—	—	—	B
<i>E. Zebra</i> v. <i>saxonica</i> (Kütz.) Grun.		—	—	A	F	R	—	R	—	F B
<i>E. Cocconeis flexella</i> (Kütz.) Cl.		—	—	—	—	R	—	R	—	F
<i>Eunotia arcus</i> Ehr.		—	—	—	—	C	—	—	—	F
<i>E. arcus</i> v. <i>fallax</i> Hustedt		—	—	—	—	R	—	—	—	F

	Sample No. Stratum	6 A	5 A	4 B	3 D	1 F	10 F	2 G	9 I	Habitat
<i>E. lunaris</i> (Ehr.) Grun.		—	—	—	R	F	F	—	—	F
<i>E. lunaris</i> v. <i>minor</i> Schum.		—	—	—	—	R	—	—	—	F
<i>E. pectinalis</i> (Kütz.) Rabh.		—	—	—	R	F	R	—	—	F
<i>E. valida</i> Hustedt		—	—	—	—	F	—	—	—	F
<i>Fragilaria brevistriata</i> Grun.		—	—	—	—	—	A	F	—	F
<i>F. brevistriata</i> v. <i>inflata</i> (Pant.) Hustedt ...		—	—	—	—	F	R	—	—	F
<i>F. construens</i> (Ehr.) Grun.		—	—	R	—	R	C	—	—	F
<i>F. leptostauron</i> (Ehr.) Hustedt		—	—	R	—	F	C	F	—	F
<i>Gomphonema acuminatum</i> Ehr.		—	—	—	F	—	—	R	—	F
<i>G. acuminatum</i> f. <i>Breissonii</i> (Kütz.) Cl. ...		—	—	—	—	—	R	—	—	F
<i>G. acuminatum</i> v. <i>coronatum</i> (Ehr.) W. Sm.		—	—	—	C	C	F	R	—	F
<i>G. acuminatum</i> v. <i>elongatum</i> W. Sm.		—	—	—	—	F	—	—	—	F
<i>G. angustatum</i> Kütz.		—	—	R	—	—	—	—	—	F
<i>G. angustatum</i> v. <i>producta</i> Grun.		—	—	—	F	—	—	—	—	F
<i>G. constrictum</i> Ehr.		—	—	—	—	—	F	—	—	F
<i>G. gracilis</i> v. <i>dichotomum</i> (Kütz.) V. H.		—	—	—	—	F	—	—	—	F
<i>G. intricatum</i> Kütz.		—	—	—	—	F	F	R	—	F
<i>G. intricatum</i> v. <i>vibrio</i> (Ehr.) Cl.		—	—	—	—	R	—	R	—	F
<i>G. lanceolatum</i> Ehr.		—	—	—	R	—	—	—	—	F
<i>G. lanceolatum</i> v. <i>insignis</i> (Greg.) Cl.		—	—	—	R	—	—	—	—	F
<i>G. parvulum</i> Kütz.		—	—	R	C	—	R	—	—	F
<i>G. parvulum</i> v. <i>micropus</i> (Kütz.) Cl.		—	—	—	C	C	—	—	—	F
<i>G. sphaerophorum</i> Ehr.		—	—	—	—	R	—	—	—	F
<i>G. subclavatum</i> Grun.		—	—	—	R	R	—	—	—	F
<i>Gyrosigma attenuatum</i> (Kütz.) Rabh.		—	—	—	—	—	R	F	—	F B
<i>Hantzschia amphioxys</i> (Ehr.) Grun.		—	—	—	—	—	R	F	—	F B
<i>Mastogloia elliptica</i> v. <i>Dansei</i> (Thw.) Grun. ...		—	—	R	—	—	—	—	—	E
<i>M. Grevillei</i> W. Sm.		—	—	—	—	F	—	—	—	F B
<i>M. Smithii</i> v. <i>lacustris</i> Grun.		—	—	—	—	F	—	—	—	F
<i>Melosira crenulata</i> v. <i>levis</i> (Ehr.) Grun.		—	—	—	R	R	—	—	—	F B
<i>M. granulata</i> v. <i>tenuis</i> Freng.		—	—	—	R	R	—	—	—	F
<i>M. italica</i> Kütz.		—	—	—	F	R	—	—	—	F
<i>Meridion circulare</i> (Grev.) Agardh		—	—	—	F	R	R	—	—	F
<i>M. circulare</i> v. <i>constricta</i> (Ralfs) V. H.		—	—	R	R	R	—	—	—	F
<i>Navicula bacillum</i> Ehr.		—	—	—	—	R	R	—	—	F
<i>N. braziliana</i> Cl.		—	—	R	—	—	—	—	—	F
<i>N. cuspidata</i> Kütz.		—	—	—	—	—	F	—	—	F
<i>N. cuspidata</i> v. <i>ambigua</i> (Ehr.) Cl.		—	—	R	—	R	—	R	—	F
<i>N. dicephala</i> Ehr.		—	—	R	R	R	C	—	—	F
<i>N. exigua</i> (Greg.) Müll.		—	—	—	—	—	R	R	—	F B
<i>N. mutica</i> Kütz.		—	—	R	—	—	—	—	—	B M
<i>N. mutica</i> v. <i>Cohnii</i> (Hilse) Grun.		—	—	R	—	—	—	—	—	B
<i>N. oblonga</i> Kütz.		—	—	—	C	F	F	R	—	F B
<i>N. pupula</i> Kütz.		—	—	—	R	—	R	—	—	F

	Sample No.	6	5	4	3	1	10	2	9	Habitat
	Stratum	A	A	B	D	F	F	G	I	
<i>N. radiosa</i> Kütz.		—	—	—	F	R	—	R	—	F
<i>N. rhynchocephala</i> v. <i>amphiceros</i> (Kütz.)										
Grun.		—	—	—	R	—	—	—	—	B
<i>Neidium amphigomphus</i> (Ehr.) Pfitz.		—	—	—	—	R	—	—	—	F
<i>Neidium iridis</i> (Ehr.) Cl.		—	—	—	R	C	F	R	—	F
<i>N. iridis</i> v. <i>vernalis</i> Reichelt		—	—	—	R	—	—	—	—	F
<i>Nitzschia amphibia</i> Grun.		—	—	R	F	R	—	—	—	F
<i>N. commutata</i> Grun.		—	—	R	—	—	—	—	—	F B
<i>N. denticula</i> Grun.		—	—	—	—	—	C	F	—	F
<i>N. thermalis</i> v. <i>minor</i> Hilse		—	—	R	—	—	—	—	—	F B
<i>N. tryblionella</i> v. <i>salinarum</i> Grun.		—	—	R	—	—	—	—	—	B
<i>Pinnularia borealis</i> Ehr.		—	—	—	R	—	—	—	—	F
<i>P. Brebissonii</i> (Kütz.) Rabh.		—	—	F	F	F	—	R	—	F
<i>P. Brebissonii</i> v. <i>diminuta</i> (Grun.) Cl.		—	—	R	R	—	—	—	—	F
<i>P. dactylus</i> Ehr.		—	—	—	—	—	—	R	—	F
<i>P. leptosoma</i> (Grun.) Cl.		—	—	R	R	—	—	—	—	F
<i>P. major</i> (Kütz.) Rabh.		—	—	—	R	F	—	R	—	F
<i>P. major</i> v. <i>linearis</i> Cl.		—	—	—	—	R	—	—	—	F
<i>P. nobilis</i> Ehr.		—	—	—	—	R	—	—	—	F
<i>P. viridis</i> (Nitzsch.) Ehr.		—	—	R	R	C	—	R	—	F
<i>P. viridis</i> v. <i>intermedia</i> Cl.		—	—	—	R	F	—	—	—	F
<i>Rhoicosphenia curvata</i> (Kütz.) Grun.		—	—	—	—	—	—	R	—	F B
<i>Rhopalodia gibba</i> (Ehr.) Müll.		R	—	A	C	R	—	F	—	F B
<i>R. gibberula</i> (Ehr.) Müll.		R	—	A	C	—	—	—	—	B M
<i>R. gibberula</i> v. <i>protracta</i> (Grun.) Müll.		—	—	R	—	—	—	—	—	F B
<i>R. gibberula</i> v. <i>producta</i> (Grun.) Müll.		—	—	A	—	—	—	F	—	F B
<i>R. parallela</i> (Grun.) Müll.		—	—	R	—	—	—	—	—	F
<i>Stauroneis anceps</i> v. <i>gracilis</i> (Ehr.) Cl.		—	—	—	—	—	—	R	—	F B
<i>S. phoenicenteron</i> (Nitzsch.) Ehr.		—	—	F	C	F	F	R	—	F
<i>S. Smithii</i> Grun.		—	—	F	R	F	R	R	—	F
<i>Surirella robusta</i> v. <i>splendida</i> (Ehr.) V. H. ..		—	—	—	R	R	—	—	—	F B
<i>S. spiralis</i> Kütz.		—	—	—	—	—	—	C	—	F
<i>Synedra capitata</i> Ehr.		—	—	—	—	R	—	—	—	F
<i>S. ulna</i> (Nitzsch.) Ehr.		—	—	—	R	C	C	F	—	F
<i>S. ulna</i> v. <i>biceps</i> (Kütz.) Schönfeldt		—	—	—	—	C	C	—	—	F
<i>S. ulna</i> v. <i>danica</i> (Kütz.) Grun.		—	—	—	—	F	—	—	—	F
<i>S. Vaucheriae</i> Kütz.		—	—	—	—	—	F	—	—	F

DISCUSSION

The Staked Plains of Eastern New Mexico and Northwest Texas have been for some years a field of geological study. In connection with this several diatom reports have been made. But until Lohman (1936) no ecological study in regard to the diatoms was made. Cope (1890) and

Woolman and Kain (1892) studied fossils from Crosby County, Texas; Woolman and Kain determined the diatoms. This deposit from Blanco Canon was determined by Cope as being Pliocene. Some of the diatoms found by them are also common in the Clovis material. Edwards (1906) studied diatoms from Mulberry Cañon and the Dockum beds, Texas. In this paper he states that the Staked Plains were an extensive mesa in late Tertiary or Quarternary times covered with fresh water. In this same paper Woolman and Kain also reported on the diatoms present. Many of the species are also in the Clovis material. Lohman (1936) studied the diatoms from the blue clay strata of the Gravel Pit at Clovis, as well as deposits from Anderson Lake. He noted that the diatoms in the blue clay strata of the Gravel Pit indicated an increase in the salt concentration of the water as the samples progressed upward through the layers. The results of this study support his conclusions.

Several other deposits of diatomite have been noted in this general region such as reported by Blake (1902) on Arizona diatomite. Fresh water diatom deposits have been reported from under Great Salt Lake, (Patrick, 1936). These deposits were probably laid down in late Pleistocene or Recent times. Hanna (1932) reported on a fresh-water Pliocene deposit from Kansas. Several of the species common in that deposit were also common in some of the strata studied at Clovis. Several fresh-water diatom deposits from Kansas which are believed to be late Pleistocene and Recent have been reported on by Elmore (1896) and Barbour (1894-95).

A study of the distribution of the various species through the various layers shows some interesting relationships. Sample 9, taken from the yellow sand, contained no true diatom flora. Several broken specimens and a few whole ones were found.

The first real diatom flora is found in Sample No. 2 which is taken from the speckled sand. The most common forms, *Amphora ovalis* Kütz., *A. ovalis* v. *pediculus* (Kütz.) V. H., *Anomoconeis sphaerophora* (Kütz.) Pfitzner, *Cocconeis disculus* (Schum.) Cl., *Navicula dicephala* Ehrenberg, and *Surirella spiralis* Kütz, indicate a fresh to slightly brackish water condition. Hanna (1933) states that *Anomoconeis sphaerophora* (Kütz.) Pfitzner occurs in fresh-water fossil deposits. The common occurrence of *Amphora ovalis* Kütz. and frequent finding of such forms as *Fragilaria brevistriata* Grun., *F. leptostauron* (Ehr.) Hustedt, *Synedra ulna* (Nitzsch.) Ehr., and *Cymbella cymbiformis* (Kütz.) Bréb., would seem to indicate lakes or ponds. At least the water conditions in which they lived were devoid of swift currents.

According to the stratigraphy the blue clay is subdivided into several layers. Samples 1 and 10 are taken from the lowest part of the blue clay. It is in this level that the richest diatom flora occurs. In comparison with

the speckled sand we find a change in the common and abundant forms. The dominant genus in this sample is *Cymbella*. Hanna (1932) finds in a deposit in Kansas several of these same species of *Cymbella*. He states that their dominance indicates that the deposit was laid down in shallow fresh water. The frequent occurrence of *Fragilaria brevistriata* Grun., *F. construens* (Ehr.) Grun., *Eunotia lunaris* (Ehr.) Grun., and *Cocconeis thumensis* Mayer, together with the occurrence of the *Cymbellas* would indicate quiet water. These forms are mostly littoral and are found most frequently in pools, lakes, or stagnant water. About 25% of the common species are often found in brackish as well as fresh-water habitats. As compared with 45% in the previous layer this would seem to indicate a decided freshening of the water in which these diatoms lived.

Sample 1, which was taken from the material in which some mammoth bones were embedded, is almost pure diatomite. Samples 1 and 10 being from the same level have about the same species. The common species in Sample 1 are *Cymbella cistula* (Hemp.) Kirchn. *Eunotia arcus* Ehr., *Gomphonema acuminatum* v. *coronatum* (Ehr.) W. Sm., *G. parvulum* v. *micropus* (Kütz.) Cl., *Neidium iridis* (Ehr.) Cl., *Pinnularia viridis* (Nitzsch.) Ehr., *Synedra ulna* (Nitzsch.) Ehr., and *S. ulna* v. *biceps* (Kütz.) Schönfeldt. They are typically found in ponds, pools, or quiet water. This was the only layer in which sponge spicules were fairly abundant.

Sample 3, which is described as tough, gritty blue clay, is from about the middle of the blue strata (Text-plate). This seems to represent as far as the diatoms are concerned a transitional layer. The flora is not nearly as plentiful as in the previous stratum. Many broken pieces of diatoms are found. The common forms are *Rhopalodia gibberula* (Ehr.) Müll., *R. gibba* (Ehr.) Müll., *Stauroneis phoenicenteron* (Nitzsch.) Ehr., *Navicula oblonga* Kütz., *Gomphonema parvulum* Kütz., *G. parvulum* v. *micropus* (Kütz.) Cl., *G. acuminatum* v. *coronatum* (Ehr.) W. Sm., and *Cymbella cistula* (Hemp.) Kirchn. According to Hanna (1933) and others the species of *Rhopalodia* are characteristic of saline or brackish water, while the species of *Gomphonema* and *Cymbella* which are listed above are characteristic of fresh or slightly brackish water. The abundance of these forms in this layer may well indicate a change from fresh water to one of a higher salt content. Of the more frequent species found in this layer about 53% have fresh to brackish water habitats. This, compared with the 25% of the previous layer would indicate an increase in the salt content of the water.

Sample 4 is characterized by the abundance of species of *Epithemia* and *Rhopalodia*. Hanna and Grant (1931) state that in purely alkaline lakes which are high in carbonates and low in chlorides that *Epithemia* is one of the predominant genera. Howard (1935) speaks of the presence of shallow alkaline lakes in this region to-day. *Rhopalodia gibberula* (Ehr.) Müll.,

and *R. gibba* (Ehr.) Müll. are also found in brackish or saline waters. Thus it would seem that the diatom flora indicates water of a relatively high salt content. Other common forms are *Diploneis elliptica* (Kütz.) Cl., *Denticula elegans* Kütz., and *D. elegans* v. *Kittoniana* Grun.

Samples 5 and 6 showed no evidence of a true diatom flora. Several broken fragments and a few whole specimens were present, but these were not in sufficient number to indicate a flora.

From a study based upon the number of species and their relative abundance it appears that in the speckled sand a flora existed which was fresh to brackish in type. Then there was a decided freshening of the water and an increase in diatom flora at the bottom of the blue clay stratum. In succeeding samples progressing upwards through the blue clay, there seems to be an increase in the salinity or salt content of the water. In the brown dune sand layer the diatom flora disappears.

Cotter (1937) states, "With striking though not quite absolute uniformity, a relatively dense debris of bison bones, occasionally articulated but usually scattered and in poor state of preservation, occupies the upper two-thirds of the bluish clay layer, and ranges as much as a foot and a half into the overlying brownish sand. Only two instances of bison bones lying in speckled sand were observed. These bones lay eight inches and thirteen inches respectively below the top contact of this sand with the bluish material. The lower third of the bluish clay material was found to contain, characteristically, the upper portions of mammoth bones, which lay with an average of one-third of their bulk in the underlying speckled sand. Occasionally a mammoth bone lay entirely in the speckled sand immediately beneath the contact. In the speckled sand proper several horse bones occurred at an average depth of thirteen inches below the top contact with the bluish clay. These bones, while probably all of the same species, varied in size. Turtle carapace fragments also appeared characteristically in the speckled sand at this depth."

It is interesting to note that the change in faunal remains seem to coincide with the change in diatom flora.

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A NEW SPECIES OF GLYPTOSTOMA

BY HENRY A. PILSBRY.

Many years ago Mr. S. N. Rhoads collected a series of *Glyptostoma* at Mt. Lowe, in the San Gabriel range, California, which differed from the San Diego *G. newberryanum* by its smaller size. Subsequently I collected the same small form in Milliard canyon, back of Pasadena, and have dissected specimens, which prove to differ from the San Diego form specifically. It may be called

Glyptostoma gabrielense, new species.

Shell smaller than *newberryanum*, bay or chestnut colored, the surface highly polished, with scarcely any trace of spiral sculpture. The periphery, while not to be called subangular, is less equably rounded than in typical *newberryanum*. In a half dozen opened there were no internal septa.

Height 13.7 mm., diam. 30 mm.; $5\frac{1}{2}$ whorls. Milliard canyon.

Height 14.1 mm., diam. 29.3 mm.; $5\frac{1}{2}$ whorls. Mt. Lowe.

Height 14.2 mm., diam. 30.7 mm.; $5\frac{1}{2}$ whorls. Mt. Lowe.

Penis and accessory sac of oviduct relatively much shorter than in *G. newberryanum*, the penis being about one-third the diameter of the shell, and the accessory sac of the vagina from one-fifth to one-seventh.

Distribution: San Gabriel range back of Pasadena and on Mt. Lowe, type 97748 A.N.S.P.

NEW OR HITHERTO UNRECORDED BIRDS FROM SIAM

BY RODOLPHE MEYER DE SCHAUSENSEE.

Among the collections from Siam which, from time to time, have been arriving at the Academy, the following babblers appear to be new. They may be described as follows:

Garrulax (Stactocichla) merulinus laoensis, subsp. nov.

This new race is by far the palest and less richly colored of this species.

It is closest to *G. m. obscurus* Del. and Jab. of Chapa, Tonkin, but differs from it in having the entire upper parts more olive, less brown, and the lower parts olive instead of rich olive-brown. The throat and upper breast are spotted with black as in *obscurus*, but the ground color of those parts and the center of the abdomen are pale buffish-white instead of deep buff.

Garrulax m. merulinus Blyth, is a browner bird than *obscurus* and, therefore, this new race is more different from it than it is from *obscurus*.

Garrulax merulinus annamensis (Rob. & Kl.) has not been available for comparison, but it is a very brilliant and distinct race. Of it Delacour (Ois. Ind.-Ch. Fr., III, p. 253) says, ". . . le dessous du corps est d'un roux orangés, avec le haut de la gorge et le menton noir . . ."

Type adult ♂, A.N.S.P. No. 131089, collected at Pahom Pok, 6000 ft., North Siam, by Lucas Bah on January 31, 1938.

Measurements: Wing 99 mm., Tail 86.5, Culmen 23.5 mm.

Remarks.—Besides the type a male and a female both from the same locality have been examined. Pahom Pok is a mountain on the border of Siam and the Southern Shan States. It lies just to the north of Mung Fang in northern Siam. (Approximately 99 E., 20 N.)

These birds have been compared with two (♂ ♀) topotypes of *G. m. obscurus*, and two females of *G. m. merulinus* from Hungrum, N. Cachar.

No form of *Garrulax merulinus* has been recorded from Siam before.

Schoeniparus rufogularis khmerensis, subsp. nov.

This new race is a very dark bird and differs from all other races by its dark coloration above, especially the pileum which is chestnut instead of rufescent.

Type adult ♂ A.N.S.P. No. 114942 collected at Kratt, southeastern Siam, by Lucas Bah on December 3, 1933.

A small series of this new form consisting of four males and one female was collected at Kratt. They are all very constant in their coloration.

They have been compared with eleven specimens of the nominate form from Assam and northern Burma.

Five specimens of *S. r. major*, Baker, also have been examined. This small series consists of three males from Ban Huai Som, N. W. Siam (about 56 miles from Pak Mat, the type locality of *major*), and a pair from Ban Nam Puat, French Laos (about 90 miles from Pak Mat). Both places are close enough to the type locality for the birds to be considered typical.

A series of ten birds from Boun Tai, Muong Yo, French Laos, and Muong Boun, Muong Moun and Phong To, Tonkin, which have been identified as *blanchardi* Del. and Jab. by Kinnear for the Field Museum (Birds of the Kelley-Roosevelt Exp. by Bangs and van Tyne, Field Mus. Zool Ser. Vol. XVIII, No. 3, p. 80) seem inseparable from *major* in color, but average slightly smaller in size (*major* 57.5-63 mm., culmen 11-12., *blanchardi* wing 57-59 mm., culmen 10.5-11.5 mm.). *Blanchardi* however, was described from Phuqui, near the coast of Annam, so the Field Museum's series can hardly be considered typical of that form. I should refer the Laos and Tonkin birds before me to *major*.

The type of *S. r. kelleyi* Del. and Jab. has been examined and appears to be a very good race, with a heavy bill, and very dark gular band.

S. r. stevensi Kinnear, described from Baoha, Tonkin, has unfortunately not been available for examination, but appears to be similar to the typical form above, and differs from it by having a yellower collar across the throat. In *khmerensis* this collar is darker, less rufous and more chestnut than in *S. r. rufogularis*, and slightly darker than in *S. r. major*.

The measurements of the wing and culmen of the various specimens examined are as follows:

<i>S. r. rufogularis</i>				<i>(blanchardi)</i>			
Margherita Assam	♂	55	10	Boun Tai, French Laos	♂	58	11.5
" "	♂	59	10	" " "	♂	58	11.5
" "	♂	58	10.5	Muong Yo, " "	♂	59	11
" "	♂	55	10	" Boun, Tonkin	♂	57	11
" "	♂	61	10.5	" Moun, " "	♂	59	11
" "	♂	59	10	" " " "	♂	57	11
Dalu, Upper Chindwin	♂	58	9.5	" " " "	♂	58	11
Linha, " "	♂	56	10	Phong To, Tonkin	♀	58	11
Dalu, " "	♀	55	10	" " " "	♀	58	11.5
Nanyaseik, Upper Chindwin	♀	55	10	Boun Tai, French Laos	♀	58	10.5
Pum Sin, Upper Chindwin	♂	59	10.5	<i>S. r. kelleyi</i>			
<i>S. r. major</i>				Phuoc-mon, Annam	♂	64.5	12.5
Ban Huai Som, N.W. Siam		61	11.5	(Type)			
" " " "	♂	63	12	<i>S. r. khmerensis</i>			
" " " "	♂	63.5	11	Kratt, S.E. Siam	♂	59.5	11.5
Ban Nam Puat, French				" " " "	♂	61	11.5
Laos	♂	59	11.5	" " " "	♂	60	11
Ban Nam Puat, French				" " " "	♂	61	12
Laos	♀	57.5	11.5	" " " "	♀	56.5	11

***Stachyris chrysaea aurata*, subsp. nov.**

This is a most brightly colored little bird, olive-yellow above, similar in this respect to *S. c. chrysaea* Blyth, but differs from that bird in having the black streaks of the pileum very ill-defined instead of well marked, and the black eye streak reduced to a greyish area on the lores. Below it is intense golden yellow, much brighter than in any other form.

Specimens from Doi Souteb and Doi Chieng Dao (*S. c. assimilis* Walden) are dingy-looking birds when compared with *aurata*.

Type adult male A.N.S.P. No. 131237, collected by Lucas Bah on Pahom Pok, 6400 ft., north Siam on February 15, 1938.

Measurements: Wing 51 mm., culmen 10 mm.

It seems most curious to find such a distinct form inhabiting Pahom Pok which is but a scant fifty miles from Chieng Dao where *assimilis* is found.

Besides the type another adult male and a female have been examined which were collected at the same locality.

Of the typical form the following have been examined. One female and bird of undetermined sex from Sikkim, a pair from Assam, and a pair from Bhamo.

Four specimens of *assimilis*, two males and one female from Doi Souteb, and female from Chieng Dao, have also been examined.

The following two races have not been available for comparison; *S. r. binghami* Rippon (Mt. Victoria) which, according to Baker, has the upper parts ashy olive green, and *S. c. chrysops* Richmond (Trang) which has a black eye streak like the nominate form, and is duller yellow below.

I am much obliged to the U. S. National Museum of Washington, the Field Museum of Chicago, and the American Museum of Natural History of New York, for lending specimens for comparative purposes.

The following birds which have been received among the collections from Siam appear not to have been recorded from that country before. None is unexpected but it seems worth while to record them.

***Neohierax insignis harmandi* (Oustalet).**

Three males and four females were secured at Ubol-Chanuman, Ubol-Khemraj, and Ubol-Kulu, during December and January 1936. This locality is in extreme eastern Siam near the Mekong river, about Lat. 16°N.

The males are clearly distinguished from North Siam birds (*N. i. cinereiceps* (Baker)) by their almost white instead of gray head, nape and upper back, while the females have the same parts paler chestnut than in north Siam examples. It might be well to call attention to the fact that this form has been omitted by Peters in his "Check-list of the Birds of the World". A good figure of this bird appears in Delacour and Jabouille's "Les Oiseaux de l'Indo-Chine Française."

Bambusicola fytchii fytchii Anderson

Five males and one female of this fine game bird were secured by my collectors on Pahom Pok at 6400 feet during February 1938.

Lymnocyptes minima (Brunnich).

A male was secured by the brother of one of my collectors, at Salaya, near Nakon Pathom, central Siam, on November 25, 1928.

Dryobates catharius perneyi (Verreaux).

One male was collected at Pahom Pok at 6000 feet during February, 1938.

Paradoxornis guttaticollis David.

Three males and two females of this Parrot-bill, were secured at from 6000 to 6400 feet on Pahom Pok during February. The genus heretofore was not represented in the Siamese avifauna.

Turdus dissimilis Blyth.

A pair was collected at Pahom Pok in February, 1938.

Oreocincla dixonii (Seeborn).

A single female from Pahom Pok, 6000 feet, in February, 1938.

Sitta crinigera cooki Harington.

One male, from Ubol-Chanuman, secured in February, 1936.

WHAT IS COMMELINA COMMUNIS?

BY FRANCIS W. PENNELL.

In the issue of "Bartonia" for 1937¹ has been told the story of the two apparent species of Asiatic Dayflower that have both been passing as *Commelina communis* in the eastern United States. A pale-flowered plant with wholly yellow anthers was introduced to the Philadelphia territory early in the last century and spread through the middle and later decades so that before 1900 it was an abundant weed in most of the local gardens, and yet its American range now remains almost restricted to the valley of the Delaware River. A darker-flowered plant with madder-brown anther-centers, although now occurring over most of the eastern United States, appears to have arrived much later, the earliest American specimen in the herbarium of the Academy of Natural Sciences having been gathered in 1898. It is evident that two different plants have become naturalized from Asia.

The first to recognize the distinctness of these two dayflowers was Mr. Edward G. Vanatta of the Academy's conchological department, and his observations have been supplemented by Mr. Bayard Long and myself. There are accessory characters which seem to give to each real taxonomic value. So far as American plants are concerned, they may be distinguished by the following contrasts:

- Lobed sterile anthers wholly yellow; posterior petals larger, the blades 10-15 mm. long, ovate-oval, pale to light violet-blue²; anterior sepals shallowly concave, united less than half length; posterior flower of inflorescence well developed (although soon falling), exserted above spathe on a long stalk; spathe mostly 2-2.5 cm. long, acuminate, when opened about as wide as long, usually obscurely puberulent or glabrous; apex of leaf-sheath slightly or not ciliate; foliage pale; flowering near Philadelphia from mid-July to October. (A)
- Lobed sterile anthers yellow with madder-brown centers; petals with blades 8-10 mm. long widely ovate (as wide as or wider than long), intensely violet-blue;³ anterior sepals deeply concave, united half length, less spreading; posterior flower of inflorescence not or rarely developed, although stalk persists as rudiment less conspicuously exserted from spathe; spathe 1.5-2 cm. long, when opened wider than long, more puberulent; apex of leaf-sheath pilose-ciliate; foliage darker green and stems, etc., more frequently purple; flowering near Philadelphia from mid-June to October (B)

¹ Bartonia 19: 19-22, Mar. 8, 1938.

² As checked in Ridgway's "Color Standards and Color Nomenclature." Washington, 1912.

³ Phenyl blue, in Ridgway's nomenclature.

Which of these two is *Commelina communis* L.? That is the essential question for American botanists. When in England in 1930 I had some hope of deciding this problem by consulting the Linnean Herbarium at London, and also seeing the other collections which were studied by Linnaeus. Then I knew only the color- and the pubescence-distinctions, and so returned home with the feeling it would be all but impossible to decide the identity of the old herbarium specimens. But with the recent discovery of the habitual difference in the development of the posterior pedicel, there has at last appeared a valid character which can be correlated with pubescence in studying exsiccatae. So two years ago I passed the problem on to Dr. Harold N. Moldenke, of the New York Botanical Garden, who was then on a tour of botanical study in Europe. He has carefully analyzed each element back of the original diagnosis, and has generously supplied me with photographs of the specimens involved. The latter are those now reproduced.

Linnaeus' original description of *Commelina communis*⁴ reads:

"*Commelina corollis inaequalibus foliis ovato-lanceolatis acutis, caule procumbente glabro. Hort. ups.* 18.

Commelina foliis ovato-lanceolatis, caule procumbente glabro, petalis duobus majoribus. Virid. cliff. 6. *Hort. cliff. Roy. lugd.* 17. *Gron. virg.* 130.

Commelina procumbens annua, saponariae folio. Dill. elth. 93, t. 78, f. 89. Habitat in America."

The primary diagnosis was taken directly from Linnaeus' earlier work, "*Hortus Upsaliensis*", published in 1748, which in turn quoted from his yet earlier "*Viridarium Cliffortianum*" and "*Hortus Cliffortianus*", both of 1737. The diagnosis throughout these works was the same, except for the alteration of the phrase "petalis duobus majoribus" to the less precise "corollis inaequalibus." On our plate the right-hand figures are these plants, the upper being that of the Clifford Garden in Holland and so the basis of both the "*Viridarium*" and "*Hortus*" references, the lower (as shown by "H U" written beneath it) a specimen from the Upsala Garden in Sweden. The latter is to be accounted type of the species. Both show the posterior pedicel conspicuously projecting from the spathe; in the Clifford specimen one spathe shows it with flower, in the Upsala specimen it has already dropped its flower. Both show strongly acuminate spathes and both are described by Dr. Moldenke as with leaf-sheathes either without or with minute and obscure cilia. They make it evident that the essential element of Linnaeus' *Commelina communis* was Plant "A" of our key, the pale-flowered species which has become abundantly established near Philadelphia.

⁴Species Plantarum 40, 1753.

The specimen on the lower left of our plate, also in the Linnean Herbarium and marked by Linnaeus with "1" both before and after the specific name, is not so easily identified. Its spathes are acute or barely acuminate, if opened being slightly wider than long, its posterior filament would project only slightly beyond the spathe if the opened spathe were closed, and the leaf-sheathes are described by Moldenke as "minutely ciliate". Possibly it is "B" of our key, but, in the absence of more definite evidence of that plant in Europe so early, I think it more likely that it is rather a less fully developed specimen of "A".

Linnaeus' other references show that true *Commelina communis*, the pale-petaled plant, was that described by Adrian van Royen in his "Florae Leydensis Prodrum" of 1740, and both described and pictured in Dillenius' "Hortus Elthamensis" of 1732. The latter contains a very full description, in detail fitting well our plant; thus, the foliage was subglaucous, the two upper petals "amoene caerulei", the anthers yellow, while the illustration shows the posterior petal floriferous. There can be no doubt that this was a well-known plant in European botanical gardens.

The reference to Gronovius' "Flora Virginica" (1: 130) of 1743, as the upper left-hand specimen of our plate clearly shows, was actually to a plant of *Commelina erecta* L., a North American species at once distinguished by its spathe being connate at base, thus forming a sort of cup around the flowers. Perhaps it was because of this mistaken association that Linnaeus' considered *C. communis* to be American. Dillenius before him had credited it to the warmer American islands, evidently meaning the West Indies.

Since Linnaeus' time several new species have been proposed, which have lapsed again to the synonymy of *Commelina communis*. Let us examine at least the earlier of these, to see if perchance some may have been descriptive of "B", our darker-petaled plant.

First there is *Commelina polygama* Roth of 1790.⁵ Its upper petals were said to be pale blue and the lobed anthers sulphur-yellow with two saffron points, a combination clearly denoting *C. communis*.⁶ The name was given because Roth noticed that some of the flowers lacked styles and stigmas, such flowers being intermixed with the fertile ones. The plant was from a botanical garden.

In 1807 appeared the first clear account as well as illustration of the dark-petaled plant, but without the realization that it was not true *Commelina communis*. In P. J. Redoute's magnificent work, "Les Liliacées",

⁵ In Roemer & Usteri's Botanisches Magazin, vol. 4, pt. 10: 14.

⁶ The stem was described as purplish and the sheathes as with purple lines, coloration more usual for the dark-petaled plant. Dillenius had earlier said that sometimes the upper portions of the plant are purple, and I have myself observed such color in *C. communis*.

is a colored plate (vol. 4, tab. 206) which depicts both the dark upper petals and the brown anther-centers, while the accompanying text alludes to the spathe as acute and the sepals as concave; furthermore the illustration omits the posterior pedicel, which would hardly have been overlooked in *C. communis*. Beneath the plate is the name "*Commelina vulgaris*", but a note appended to the text corrects this to *C. communis*.⁷ It is evident that by 1807 both species were in European botanical gardens.

In 1822 a greenhouse plant of unknown origin was described as *Commelina debilis* Ledeb.⁸ It had been observed by Ledebour in the botanical garden at Dorpat, then in Russia (now Esthonia). As presented by Roemer and Schultes the proposal consisted of an essential diagnosis quoted directly from Ledebour's letter, and a supplementary description also subscribed "Ledeb." The former reads: "*Commelina debilis* Ledeb. corollis inaequalibus; involucri suborbiculatocordatis, acutis; foliis oblongo-lanceolatis, petiolatis, subglabris; vaginis hinc pubescentibus; caule erecto debili. Ledeb. in litt." The latter adds the information that the petiole is ciliate, the petals with more intense color than in *C. angustifolia*, the anthers sulphur-colored, the involucre or spathe forming a connate hood, and the posterior peduncle often sterile.⁹ The connate spathe is impossible for either of our species, but as this feature seems to contradict Ledebour's primary diagnosis of the spathe as suborbicular-cordate, I wonder if two different species may not have been included. Such a suggestion is sustained by the fact that it is apparently our dark-petaled plant "B" which is described and shown as *C. debilis* in Reichenbach's "Hortus Botanicus" (p. 20, tab. 151) of 1828, another German work issued only six years subsequently and so while interest in the subject was still fresh. Its text gives the upper petals of *C. communis* (as *C. polygama*) as ovate-oblong and pale blue ("pallide coeruleis") in contrast with *C. debilis* as reniform and bright blue ("laete coelestinis"), while the illustration shows the anterior sepals of the latter as much united. It seems likely that the earliest specific name for our dark-petaled plant would be *C. debilis* Ledeb., considering that its primary diagnosis should decide the application of the latter name.

So far all our descriptions and illustrations of Dayflowers of this group have shown us plants of European botanical gardens, of origin either unknown or supposed to be from some part of America. Just how later opinion came to favor eastern Asia as the native home of these plants I

⁷ *Commelina vulgaris* had been earlier used in a smaller manner as the legend for tab. 40 of Schmidel's "Icones" of 1783, where the plant depicted was also *C. communis*.

⁸ In Roemer & Schultes, *Mantissa* 1: 342, 1822. Also listed or described by Ledebour in *Cat. Sem. Hort. Dorpat.*, 1824, a reference not accessible to me.

⁹ "Involucrum subinde in cucullum connatum, . . . e quo pedicelli 2 quorum exterior nonnunquam sterilis, interior quadriflorus."

do not know. In C. B. Clarke's Monograph of the Commelinaceae¹⁰ in 1881 *Commelina communis* was given as common in China and Japan. We need to understand their occurrence there. The Academy's Asiatic representation of these plants is extremely meagre, our two specimens, both from Japan, being element "B".

In the hope of discovering the native territories of both these Day-flowers I have borrowed East Asiatic specimens of this group of species of *Commelina* from the United States National Herbarium, the New York Botanical Garden, and the Gray Herbarium of Harvard University.¹¹ The result has both confirmed and disturbed my anticipations. Element "B" seems usually recognizable, occurring extensively both in China and Japan and being the only wild representative of this group in the latter country. Doubtless its introduction to eastern America has resulted from commerce with Japan which commenced late in the last century. But the full combination of pale flowers and nearly glabrous growth that marks element "A", true *C. communis*, I have sought in vain in all the wealth of material at hand. The connection of the two entities is too intimate to permit of the supposition that the latter might have come from some other portion of the globe. But I have come to wonder how far it represents a definite wild species in its native home, or whether it may have been originally a pale-flowered and glabrous variant in which certain characters have become permanently set through long isolation in botanical gardens in Europe, with subsequent spread from a botanical garden in eastern North America.¹² Perhaps the counterpart of our Philadelphia weed will not be found again in the East. In their new American homes both these plants keep clearly distinct, even when growing in contact.

It is all but impossible, working merely with dried material, to appraise properly the situation in eastern Asia. Pale posterior petals are scarcely noted or evident, while foliage so glabrous as that of *Commelina communis* is quite unusual; the anther-color can rarely be checked as to dark centers; the degree of union of the anterior sepals does not form a very definite contrast; and the posterior flower of the inflorescence may occur in association with dense pubescence. Generally, hairy indumentum is more developed than in America. Yet certain tendencies are evident, and one wonders if sufficient field-knowledge would not reveal a number of well-

¹⁰ In A. & C. DeCandolle's *Monographiae Phanerogamarum*, vol. 3, p. 170. The description of the petals as "intense caerulea" shows that this detail was supplied to the account of *C. communis* by element "B" rather than "A" of our key.

¹¹ My thanks are due to the curators in charge of these collections for this assistance. Also I wish to thank Mr. Egbert H. Walker of the U. S. National Museum for citations from his forthcoming bibliography of East Asiatic botany.

¹² See *Bartonia* 19: 21, for reasons for considering that this was introduced early in the nineteenth century as a curiosity to botanical gardens near Philadelphia, Pennsylvania.

contrasted entities. At present I can but suggest the following very provisional outline of subspecific categories. Among these our element "B" is assigned the name *ludens*, dating from 1861.

- A. Posterior peduncle normally floriferous, the flower raised much above spathe; anterior sepals united less than $\frac{1}{3}$ length; spathe acuminate (or merely acute), when opened almost as long as wide (or sometimes shorter in *exserta*); leaf-blades usually long-attenuate, pale green.
 - B. Upper petals pale blue; spathe and leaf-blades glabrous or nearly so, the spathe nearly or quite eciliate and the orifices of the leaf-sheathes ciliolate to eciliate. *C. communis typica*
 - BB. Upper petals intensely blue; spathe and leaf-blades glabrate to pubescent, the spathe ciliolate to ciliate and the orifices of the leaf-sheathes usually villose-ciliate. *C. c. exserta*
- AA. Posterior peduncle normally sterile, included within or projecting only moderately above the spathe; anterior sepals united $\frac{1}{3}$ to $\frac{1}{2}$ length; spathe acute to acuminate, when opened wider than long; leaf-blades usually wider and more shortly attenuate, probably deeper green; orifices of leaf-sheathes ciliate, often villosely so.
 - B. Upper petals 8–10 mm. long; spathe straight or slightly decurved. *C. c. ludens*
 - BB. Upper petals at least 20 mm. long; spathe strongly decurved. *C. c. hortensis*

Commelina communis typica.

Commelina communis L., Spec. Plant. 40, 1753. "Habitat in America." As above explained, this is typified by a plant grown in the Upsala Botanical Garden, and now preserved in the Linnean Herbarium at London, England; this is the pale-flowered plant of botanical gardens, etc.

Commelina polygama Roth, in Roem. & Usteri, Bot. Mag. 4, X: 14, 1790. "Anno 1786 in Victili quodam cum aliis plantis sponte mihi enata est, patriam itaque indicare nequeo." Type not seen, but, as explained above, this appears to be the subspecies now considered.

This subspecies, perhaps in its origin merely a race with relatively unstable characteristics, was presumably brought from China to Europe toward the end of the seventeenth or early in the eighteenth century. Likely this was done by Dutch traders, since our earliest descriptions of it are from Holland and England. Early in the nineteenth century introduced to botanical gardens near Philadelphia, whence it has become a garden weed in that vicinity.

***Commelina communis exserta* Pennell, subsp. nov.**

Two posterior petals intensely violet-blue, 10–15 mm. long; anterior sepals united less than or about $\frac{1}{3}$ length; posterior peduncle normally floriferous, exserted much above spathe; spathe straight or slightly decurved, usually acuminate, finely pubescent (or sometimes also villose on sides), ciliolate to ciliate; leaves pale green (at least beneath), finely to rather strongly pubescent, especially beneath, the sheathes glabrous to usually finely pubescent and their orifices nearly always villose-ciliate.

(*Commelina petalis* intense violaceo-coeruleis, pedunculo posteriore florifero et exserto, spatha acuminata canescente ciliolata, foliis pallide viridibus, et vaginarum oribus villosulo-ciliatis.

Type, near Vladivostok, eastern Siberia, collected in flower in 1919 by D. LeRoy Topping, no. 2359; in United States National Herbarium.

This appears to be the only form of the species in Manchuria and eastern Siberia, whence it extends southward into China.¹³ In the northern part of its range there can hardly be doubt that the plants here separated represent a definite entity, but the scattered specimens from China, extending even to Kwangtung, suggest that I may have distinguished merely those occasional specimens of *ludens* which have the posterior peduncle floriferous. The following collections are assigned to this subspecies.

SIBERIA. Amur medius, *S. Korchinsky* (H, U); ad flum. Amur, *R. Maack* (H) and *Maximowicz* (H); prov. Amurensis, *F. Karo* (Y). Distr. Possiet, prov. Austro-ussuriensis, *A. P. Cabepkena* (Y); Lake Hanka, *Bohnhof* 164 (Y). Vladivostok, *D. L. Topping* 2305 (U), 2359 (U), *N. A. Valozevsky* (*Komarov* 343) (Y).

MANCHURIA. Haritun (90 km. n. of Mergen), *W. Stötzner* 19 (Y). Toward Sungari R., *H. E. M. James* (H). Kirin: O-muhsien, *H. W. Kung* 2388 (Y).

CHINA. Chili: near Peking, *S. W. Williams* (H).¹⁴ Shantung: Tsingtao, *Zimmermann* 251 (U). Honan: Kikungshan, *A. N. Steward* 9650 (U). Anhwei: Tze Kuan Sze, *Steward* 7146 (U). Szechuan: ———, *Ernst Faber* 202 (Y). Chekiang: H. C. College, *C. Y. Chiao* 18821 (U, Y), 18919 (U); MoKan Shan, *Cheo & Wilson* 12706 (H). Fukien: ———, *H. H. Chung* 8596 (Y). Kwangtung: Yang Mei Lang, Yao Shan, *S. S. Sin* 9371 (Y).

Commelina communis ludens (Miquel) Clarke.

(?) *Commelina debilis* Ledeb., in Roem. & Schult., Mant. 1: 342, 1822. "In Caldario." As above stated, the description may be composite, partly of a plant with connate spathes but primarily of the present open-spathed plant.

Commelina ludens Miq., in Journ. Bot. Neerl. 1: 88, 1861. "Croît sur les collines pres de Fukwing [Kwangtung, China]." Type not seen nor verified, but description applicable to this, the prevalent form in Kwangtung.

Commelina communis ludens (Miq.) Clarke, in A. & C. DeCandolle, Monog. Phaner. 3: 171, 1881.

Widespread and locally common in Japan and China. As in American plants seen, the posterior petals appear to be regularly intensely violet-blue and presumably the lobed sterile anthers are brown-centered. It varies

¹³ Probably this is *Commelina martyrum* Levl. (in Repert. Nov. Spec. Regn. Veg. 5: 284, 1908) from the vicinity of Seoul, Korea ("in martyrum de Beaulieu de Bretenniere Tumulo apud Seoul, 15 Sept. 1889, Em. Bodinier"), although the short description, emphasizing mainly the amount of hairiness, might apply as well to *C. communis ludens*. I have seen no specimens from Korea, and it is possible that either or both may grow near Seoul.

¹⁴ Plant nearly glabrous, but upper petals apparently dark in color.

much in amount and distribution of pubescence, an extreme state with spathes and sheathes ciliate with long hairs being called below forma *ciliata*.¹⁵

JAPAN. Yezo: Sapporo, S. Arimoto (H). Honshu: *Aksawa, Ugo, — (Y); Kurozawa, P. H. Dorsett & W. J. Morse 590 (U, Y); Takata, Musashi, G. Masamune (Y); Tokio, J. Matsumura (U); Yokoska, Savatier 1218 (U); Simoda, Williams & Mann (H), C. Wright (H, U). Kiushiu: Hakozaki, Fukuoka, K. Ichokawa 96 (H, U); Mt. Wakasugi, Chikuzen, M. Takenouchi 624 (U); Nagasaki, R. Oldham 857 (H).

CHINA. Chili: Western hills, Dorsett & Morse 7024 (U). Hopei: Hsiang Shan, J. C. Liu 159 (Y), H. Sheehan 204 (Y).¹⁶ Kiangsu: Kiangyin, A. Allison 128 (H);¹⁷ Nanking, A. N. Steward 2068 (U), *Ni Wen Hsing 128 (Y); Soochow, H. T. Feng (H).¹⁷ Anhwei: Chiu Hua Shan, R. C. Ching 8419 (U), *S. C. Sun 1161 (Y); *Li Shan, Ching 8734 (H, U). Hupeh: *Ichang, A. Henry (Y), Patung Hsien, Ho Chang Chow 731 (Y); Wuchang, L. H. Bailey (H), *Sun 781 (Y). Szechuan: *Changyang, E. H. Wilson (H); *Hanyuan Hsien, W. P. Fang 3767 (H, U); Pehchuan Hsien, Fang 5594 (H, U). Chekiang: Tien Tai Shan, C. Y. Chiao 14337 (U), 14581 (U). Kweichow: Pinfa, Kweiting, Y. Tsiang 5393 (Y); Shuicheng, Tsiang 9455 (Y); *Liang Feng Yah, Tsunyi Hsien, Steward 267 (Y). Kiangsi: Ihwang, Tsiang 10023 (Y); Lushan Mts., Chung & Sun 499 (Y). Fukien: —, H. H. Chung 6469 (Y). Kwangsi: Ta tse Tsuen, Yung Hsien, Steward & Cheo 111 (H, Y). Kwangtung: Sun Yatsen Univ., Canton, N. K. Chun 43104 (Y).

***Commelina communis hortensis* Makino.**

Commelina communis hortensis Mak., in Bot. Mag. Tokyo 15: 64, 1901. "Hab. Prov. Musashi: Tokyo, Bot. Gard. Sc. Coll. Imp. Univ., cult. (Herb. Sc. Coll. Imp. Univ. Tokyo, July 19, 1879; T. Makino, Aug. 1895)."

Apparently developed by cultivation from *Commelina communis ludens* as it occurs in Japan. Makino says of it: "A cultivated form much larger than the typical one. Blue juice of their petals is used for dyeing in the manufacture of a kind of paper called Boshi-gami, or Ai-gami; it is a famous product of Yamada-Village, Kurimoto-gori, prov. Omi." The two collections seen bear the Japanese names of "Obosi" and "Oboshibana".

¹⁵ *Commelina communis ludens* f. *ciliata*, forma nova. Spathae et foliorum vaginae pilis longis ciliatae. Type, collected in fruit October 16, 1928, on a roadside, 8000-9000 ft. altitude, at Hanyuan Hsien, Szechuan, by W. P. Fang, no. 3767; in United States National Herbarium, isotype in Gray Herbarium of Harvard University. This form is denoted by asterisks on the following list.

¹⁶ Labeled as "flowers whitish", but the dried petals remaining shriveled are dark blue. The posterior peduncle is short and sterile, but the plant is glabrate.

¹⁷ *Commelina communis ludens* f. *caudata*, forma nova. Spathae caudatae. Type, collected at Kiangyin, Kiangsu by A. Allison; in Gray Herbarium of Harvard University. Only collections seen.

They are both presumably from cultivation, one gathered by J. Matsumura at Tokio July 19, 1879, and the other (without locality or collector) dated Sept. 19, 1910; both are in the United States National Herbarium.

A SUPPLEMENTAL NOTE CONCERNING COMMELINA NUDIFLORA

In my account of "The Genus *Commelina* (Plumier) L. in the Eastern United States",¹⁸ presented in 1916, I called attention to the fact that two different species had been maintained in recent works, both based directly upon *Commelina nudiflora* L., Spec. Plant. 41, 1753. One of these was still known by that name, but the other as *Ancilema nudiflorum* (L.) Kunth, 1843. Photographs then sent me by Dr. B. Daydon Jackson showed that Linnaeus had named the plant "nudiflora" because of its absence of a spathe, characterizing it as "involucro nullo". The plant of his herbarium was clearly the *Ancilema*. For the current *Commelina* "nudiflora" I adopted the name *C. longicaulis* Jacq., 1789, being certain that it applied to the widespread plant of tropical America, while contradictions of description and illustration made me think that the earlier *C. diffusa* Burm. f., 1768, from Ceylon, could hardly be identified. *C. caroliniana* Walt., 1788, I treated as a different species, assigning to it narrower-leaved plants with longer-acuminate spathes. The last proposition has subsequently become unsatisfactory to me, as the supposed differences have not been sustained by later collections.

Just a year ago Dr. E. D. Merrill discussed the situation anew.¹⁹ With the help of Mr. J. E. Dandy of the British Museum he has shown anew that *Commelina nudiflora* L. must become *Ancilema nudiflorum* (L.), which combination he finds was made by Wallich in 1830. For the long-used "*Commelina nudiflora*" he is able to adopt *C. diffusa* Burm. f., after checking the type preserved in Holland. With this solution of the problem I am glad to concur. Further study has fully convinced me of the identity of this weed through the warm portions of both hemispheres. It shows considerable variability, and quite readily includes what I have attempted to separate into two species in the flora of the southeastern United States. According to my present opinion, both *Commelina caroliniana* Walt. and *C. longicaulis* Jacq. should pass into the synonymy of *C. diffusa* Burm. f.

EXPLANATION OF PLATE 8

Upper figures, specimens preserved at British Museum (Natural History) in London, England: on left, a plant collected by Clayton in Virginia and studied by Gronovius in Holland; on right, a plant grown in Clifford Garden in Holland. Lower figures, specimens preserved in the Linnean Herbarium at London, that on right being from the Botanic Garden at Upsala, Sweden. Photographs by Dr. H. N. Moldenke.

¹⁸ Bull. Torrey Bot. Club 43: 96-111. Also discussed under *Ancilema*, p. 96.

¹⁹ Journ. Arnold Arbor. 18: 64-66.

**A REVISION OF THE NEOTROPICAL EUTHYMIÆ
(ORTHOPTERA, ACRIDIDÆ, CYRTACANTHACRIDINÆ)**

BY JAMES A. G. REHN.

There is no habitat more interesting in its locust inhabitants than the vine-tangles of tropical or subtropical forests. Those found in the foliage-interlaced mats of the forest's lower story and of the more ample camouflage-like screens mantling "sunlight holes" in the rain forest, are no more remarkable and varied than the types to be met in more xerophytic, closely entwined and nearly impenetrable masses in or on the borders of the less humid forests of those tropical areas having marked wet and dry seasons.

In the tropics of both hemispheres are many acridids limited to this distinctive ecological niche, often quite strangely specialized and most of them but imperfectly known, as they are rarely found by the casual collector. Due to the character of their habitat they are seldom seen except when particularly sought. Compared with the forms which live on the leaf foliage of the forest, eager for the siftings of sunlight reaching down through the chinks of the overhead canopy, these denizens of the vines lead much more secretive lives. Sometimes their structure shows a concavity of the ventral surface which permits them to fit more closely against the stems of their vine habitat. Their limbs and even parts of the sterna and abdomen may have brushes of long hairs. In addition the cephalic and median limbs are occasionally modified to grasp securely between the femora and tibiae vine branchlets and leaf bases, a hold which only hard beating or vigorous shaking will break.

One of these groups, belonging to the subfamily Cyrtacanthacridinae, has long been of exceptional interest to me, since I have had the good fortune to be able to collect a considerable portion of its species now known to occur in tropical America. This is the assemblage centering about the genera *Rhcnoderma* and *Mezentia*, to which Brunner gave the group name Mezentia. In the Philadelphia collections we have nearly all of the forms of the group, including all but five of the known types (including those of synonyms). Of the types belonging elsewhere, I have, in the course of the present study, examined all but two, which are in the British Museum of Natural History, and the Vienna Museum.

From my first acquaintance with this group in nature in 1923, I had hoped to be able to make a critical study of its New World members. Exceedingly rare as they are in all collections, and sometimes known only

from the unique types, this desire naturally remained for some years merely a pious wish. Subsequent field work in Costa Rica in 1927 and Honduras in 1930, however, added further material, and various other extensive faunistic collections brought in now and then an additional specimen or so.

The total series of the American species now available is quite small (totalling but 41 specimens), but apparently it is more ample, and clearly more representative, than any which could at this time be assembled elsewhere. In consequence this contribution is presented merely as a preliminary revision, in the hope that its fundamentals will prove to be sound, and basic for a more comprehensive study when new information warrants one. Where no identifying abbreviation is given for the source of material here recorded, it is to be understood the same is in the collection of this Academy.

At present I am restricting my discussions to the American genera, leaving for later consideration the many involved and perplexing points drawn from a preliminary study of the Old World members of the Euthymiae. The New World forms stand reasonably apart, and their phylogeny can be discussed more satisfactorily at a later date with that of the more numerous Old World genera, work on the available material of which is not complete at this time.

For assistance which has made the present study possible, I wish to thank particularly the authorities of the Museum of the University of Greifswald, who kindly loaned me the unique type of Gerstaecker's *Rhcnoderma olivacea*, the greatest essential for a proper understanding of the genus and species; Dr. B. P. Uvarov and the authorities of the British Museum of Natural History for the privilege of examining and figuring a male specimen of the exceedingly rare *Bactrophora dominans* of Westwood; Dr. Nathan Banks, of the Museum of Comparative Zoölogy at Harvard University, for the loan of unstudied material of the group and the opportunity to examine the unique type of *Rhcnoderma basalis* Bruner, there contained; Dr. E. A. Chapin, of the United States National Museum, for the loan of a specimen of *Mezentia gibbera* (Stål), and the authorities of the Museum of the University of Michigan for permission to study certain specimens of the genus *Cristobalina*.

Group Associations of Included Genera

The first author to associate in groups genera here discussed was Brunner von Wattenwyl, who in 1893¹ placed *Mezentia* Stål and *Rhcnoderma* Gerstaecker in a group *Mezentiae*, along with *Hisychius* and *Dicaearchus* Stål, both of which latter, it is now evident, have little in com-

¹ Ann. Mus. Civ. Stor. Nat. Genova, XXXIII, p. 135.

mon with the two first-mentioned genera and should be removed from their vicinity. Lawrence Bruner in the "Biologia"² followed Brunner's general arrangement without comment, although group names were not used. His knowledge of the genera, other than in the literature, was limited to *Rhcnoderma* and his *Scolocephalus* (= *Bactrophora* Westwood).

Kirby in 1910 in his "Synonymic Catalogue,"³ continued the association proposed by Brunner, doubtless because none of the genera then involved were before him, and placed *Bactrophora* Westwood, and *Scolocephalus* Bruner, amended by Kirby to *Scolecocephalus*, near the African *Pristocorypha* Karsch and in the *Ischnacrida* complex of the subfamily, doubtless on their common possession of a fastigial process.

In 1921 Martínez,⁴ in reporting a male specimen of *Bactrophora dominans*, discussed the position which had been given to the genus, and its synonym *Scolocephalus*, and after quoting the unpublished opinion of Dr. Ignacio Bolívar that greatest analogy is seen with the group Mazacae, an African assemblage of quite different composition, he created a new group, the Bactrophorae, for *Bactrophora*, and another, the Pristocoryphae, for the African genus *Pristocorypha* Karsch,⁵ which like *Bactrophora* possesses a rostrate fastigial process. The genus *Pristocorypha* has since been placed in the Euthymiae by Ramme, a position confirmed by material of that genus now before me.

Ramme in 1929,⁶ from a study of African genera, decided that *Rhcnoderma* was a member of the same group as Stål's Madagascar genus *Euthymia*, along with a number of African, Malagasy and Oriental genera, including Karsch's *Pristocorypha*. For this group he used the name Euthymiae, proposed by Brunner in 1893, at the same time as Mezentiae, for *Euthymia* and other Malagasy and African genera. Unfortunately Ramme apparently was unacquainted with Stål's *Mezentia*, which he did not mention, or he would at once have realized the affinity of *Rhcnoderma* with *Mezentia*, the two of which are distinctly more nearly related to one another than either is to *Euthymia*.

In a forthcoming paper I am discussing at length my general conclusions as to the group association and general phylogeny of most of the Old World genera related to those here treated. At this writing I do not wish to anticipate that study, which is not as yet in final form. However, I am warranted in saying the major features of Ramme's arrangement are valid, and that notwithstanding the remarkable form diversity seen in the

² Biol. Cent.-Amer., Orth., II, pp. 247-250, (1907-1908).

³ Vol. III, pp. 390-391, 406.

⁴ Tomo Cincuentenario. Mem. R. Soc. Españ. Hist. Nat., pp. 504-505.

⁵ He also suggested this group may be found to include the African genus *Escalera* I. Bolívar.

⁶ Mitth. Zoolog. Mus. Berlin, XV, Heft 2, p. 285.

limited number of American genera they all fall naturally into the group Euthymiae, which, nevertheless must have some modification of Ramme's ideas of its components.

As *Euthymia* was proposed as a generic name three years before *Mezentia*, I have retained the group name based on the former rather than that formed from the latter. In addition, while both group names date from Brunner's Revision (1893), Euthymiae has line priority over Mezentiae.

Key to Genera

This key to the American genera is a purely artificial one, intended solely to enable the student to distinguish them. The systematic treatment which follows the key gives the proper linear sequence of the forms here treated, but does not take into consideration the relationships with Old World genera, which will be discussed in a subsequent paper.

1. Apterous, or with tegmina mere lobiform slips and wings absent. Fastigium in profile very strongly declivent. Metazona of pronotum distinctly less than half as long as prozona. Lateral lobes of pronotum nearly or quite as broad as dorsum of same is long. Prosternal process transversely carinate or subcarinate 2
- Alate, with functional tegmina and wings. Fastigium variously developed. Metazona of pronotum not less than half as long as prozona. Lateral lobes of pronotum distinctly not as broad as dorsum of same is long. Prosternal process spiniform, rounded or compressed, never transverse 4
2. Completely apterous. Metazona of pronotum not cristato-carinate mesad; pronotal dorsum not at all concave. Juxta-ocellar areas without corniform tubercles. Surface as a whole rugulose to cribrosopunctulate, not strongly rugose. Pattern of the external paginae of the caudal femora not deeply etched. 3
- Tegmina present as minute ovate pads. Metazona of pronotum cristato-carinate mesad; pronotal dorsum concave mesad. Juxta-ocellar areas with a pair of decided corniform tubercles. Surface as a whole multi-rugose, with innumerable tubercles as well as lineations. Pattern of the external paginae of the caudal femora etched into marked relief. (Southern Mexico and Yucatan.)*Cristobalina*, new genus
3. Ventral margins of caudal femora entire, not serrato-dentate. Epimeri of mesopleura not inflated or glabrous; mesonotum not tumid. Interspace between mesosternal lobes quadrate or transverse. Second article of caudal tarsi shorter than distal one. (Southern Mexico to Panama.)*Rhcnoderma* Gerstaecker
- Ventral margins of caudal femora serrato-dentate. Epimeri of mesopleura appreciably inflated and glabrous; mesonotum distinctly tumid. Interspace between mesosternal lobes longitudinal. Second article of caudal tarsi equal in length to distal one. (Panama.)

Panamacris, new genus

4. Fastigium not rostrate; fastigio-facial angle obtuse in profile. Pronotum broad, subsellate, with at most relatively low scattered surface tubercles. Tegmina and wings at most extending but little caudad of middle of abdomen; principal venation of tegmina largely obscured in a general anastomosing. Wings not solidly opaque in coloration. (Honduras to Upper Amazonia.) *Mezentia* Stål
- Fastigium strongly produced, conically rostrate, apex moderately or not at all expanded. Pronotum relatively narrow, dorsal line straight in profile, not at all sellate, surface of dorsum and dorsal portion of lateral lobes with spaced series of marked and elevated tubercles. Tegmina and wings falling but little short of apex of abdomen; principal venation of tegmina with a pronounced and regular, completely longitudinal disposition of principal veins. Wings solidly opaque in coloration. (British Guiana, Colombia and Costa Rica.)
Bactrophora Westwood

Sequence of Genera and Species (with synonyms)

Panamacris, new genus

P. magnifica (Hebard). Panama. (Type examined in Hebard Collection.)

Rhcnoderma Gerstaecker

R. olivaceum Gerstaecker. Panama and Costa Rica. (Type examined from Museum of the University of Greifswald, Germany.)

—*R. glabra* Bruner. (Type examined in Hebard Collection.)

R. humile Rehn. Costa Rica. (Type examined in Academy Collection.)

R. basale Bruner. Southern Mexico. (Type examined in Museum of Comparative Zoölogy, Cambridge, Mass.)

—*R. pugnax* Bruner. (Type examined in Hebard Collection.)

(*Lempira*, new subgenus)

R. (L.) archimimus, new species. Honduras. (Type belonging to Museum of Comparative Zoölogy, Cambridge, Mass.)

R. (L.) arcanum, new species. Honduras. (Type belonging to Academy.)

Cristobalina, new genus

C. sellata, new species. Southern Mexico and Yucatan. (Type belonging to Hebard Collection.)

Mezentia Stål

M. gibbera Stål. Panama.

M. cutteri, new species. Honduras. (Type belonging to Academy.)

M. visenda, new species. Amazonian Peru. (Type belonging to Hebard Collection.)

M. acanthopyga, new species. Amazonian Brazil. (Type belonging to Hebard Collection.)

Bactrophora Westwood

— *Scolocephalus* Bruner

— *Scolecocephalus* Kirby. (Emendation.)

B. dominans Westwood. British Guiana to Colombia.

B. mirabilis (Bruner). Costa Rica. (Type examined in Hebard Collection.)

Apropos of the linear arrangement given above it is evident that in the American genera we have four definite lines of development, regardless of what terms are employed for them. One centers about *Rhcnoderma* and includes *Panamacris*. The subgenus *Lempira* of *Rhcnoderma* shows a definite but less impressive line of divergence away from the norm of the genus and is very markedly the antithesis, in its own aggregation, of *Panamacris*. The new genus *Cristobalina* is a very sharply marked-off stock, quite distinct from any other but having more in common with *Rhcnoderma* than with *Mezentia*. The latter has a sharply cut and characteristic facies, while *Bactrophora* is superficially so different from the other members of the group it is only after careful study that one can be sure of its group association. I have placed *Bactrophora* with the Euthymiae on account of its possession of many less evident features common to all or most members of the group, such as a characteristic but hardly describable twist of the proximo-dorsal margin of the caudal femora, the proximal deepening of the caudal tibiae, the modification of the structure of the cephalic and median limbs to grasp vines seen in all the American members of the group, and the similarity of the basic elements of the pronotum, as well as the sternal structure as a whole. The parallel lateral lines of long setae present distad on the ventral surface of the abdomen also are as marked in *Bactrophora* as in most of the other genera here treated.

Systematic Treatment

PANAMACRIS,⁷ new genus

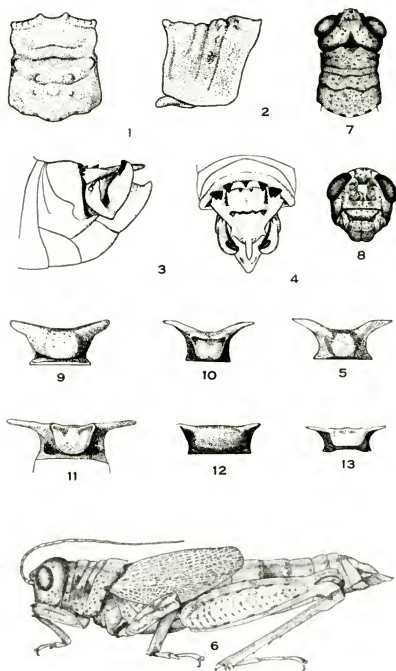
1924. *Rhcnoderma* Hebard (in part), Trans. Amer. Entom. Soc., L, p. 110, pl. VIII, fig. 2.

Genotype.—*Rhcnoderma magnificum* Hebard.

The striking and distinctive locust on which this new genus is based combines a number of features not found in the forms here placed in *Rhcnoderma*. For the sake of consistency in treatment, as well as a true interpretation of the phylogenetic units of the group, it is necessary to erect a new genus for this vividly colored and strangely formed insect.

In *Panamacris* the ventral margins of the caudal femora are serratodentate, a condition found as marked in no other member of the group, the epimeri of the mesopleura are quite appreciably inflated, glabrous and polished, and the mesonotum distinctly tumid, both quite different in these respects from the same areas in any other genus of the Euthymiae, the interspace between the mesosternal lobes is longitudinal, instead of quadrate or transverse as in *Rhcnoderma*, while the proximal and second articles of the caudal tarsi are subequal in length, instead of the second being shorter than the proximal one, as in the latter genus.

⁷ *Panama* and ἀπίς locust, in allusion to the habitat of the genotypic species.



Text-figures 1-13.

Mezentia gibbera Stål. Male. Porto Bello, Panama. Fig. 1.—Dorsal view of pronotum ($\times 3$). Fig. 2.—Lateral view of pronotum ($\times 3$). Fig. 3.—Lateral view of apex of abdomen (greatly enlarged). Fig. 4.—Dorsal view of apex of abdomen (greatly enlarged). Fig. 5.—Cephalic portion of prosternum and prosternal process as seen in ventral aspect (greatly enlarged). *Mezentia cutteri*, new species. Male (type). Lan-cetilla, Honduras. Fig. 6.—Lateral view ($\times 1\frac{1}{2}$). Fig. 7.—Dorsal view of head and pronotum ($\times 1\frac{1}{2}$). Fig. 8.—Cephalic view of head ($\times 1\frac{1}{2}$). Fig. 9.—As figure 5. *Pana-macris magnifica* (Hebard). Male (type). Gatun, Canal Zone, Panama. Fig. 10.—As figure 5. *Rhicnoderma olivaceum* (Gerstaecker). Female (type of *R. glabra* Bruner). Pozo Azul, Costa Rica. Fig. 11.—As figure 5. *Rhicnoderma archimimus* new species. Female (type). Subirana, Honduras. Fig. 12.—As figure 5. *Cristobalina sellata* new genus and species. Male (allotype). Chichen Itza, Yucatan. Fig. 13.—as figure 5.

The genus *Panamacris* occupies a rather isolated position among the American genera of the Euthymiae, its nearest relationship being with *Rhcnoderma*, and in linear arrangement we are placing it before that genus. Apparently *Panamacris* has no nearer relative among the numerous Old World members of the group.

Generic features.—Apterous. Surface almost entirely impresso-punctate, very sparsely hirsute on ventral surface and limbs. Fastigium subvertical, evenly passing into face without transverse division; in form transversely and broadly cuneiform; surface of fastigium medio-longitudinally carinate; frontal costa quadrate dorsad of median ocellus, at that point with a transverse carina, at level of ventral border of antennal scrobes sharply narrowed and failing to reach clypeal suture: antennae with 22 articles. Pronotum sub-tumid with transverse sulci deeply impressed, none severed mesad and no median carina present; cephalic margin of disk marked concavo-emarginate mesad, flanked by a pair of distinct marginal nodes, caudal margin of disk subtruncate. Mesonotum and mesopleura inflated, epimeri of mesopleura polished. Prosternal process transversely trenchant, margin with lateral angles triangularly elevated; mesosternum in male with interspace between lobes distinctly longitudinal; metasternal lobes in male broadly attinent. No external auditory tympana evident. Cerci of male simple, styliiform. Cephalic femora and tibiae robust, rhcnodermoid, subdeplanate on flexor surfaces: median femora deepening distad, cephalic genicular lobe much larger than caudal. Caudal femora thick in proportion to depth, medio-dorsal and both ventral carinae biserially serrato-serrulate, genicular lobes with ventral margin obtuse-angulate produced mesad, distal point of same subacute; caudal tibiae with flexor surface deplanate; external spines on extensor surface subcompressed, eight to nine in number, one apical; spines of internal margin less expanded, nine in number, one apical; caudal tarsi elongate, slender, proximal and second articles subequal in length.

Distribution.—But a single species, *Panamacris magnifica* (Hebard), from eastern Panama, is known.

Panamacris magnifica (Hebard). Text-fig. 10; plate 1, figs. 5 and 6; pl. 3, fig. 11,

1924. *Rhcnoderma magnificum* Hebard, Trans. Amer. Entom. Soc., L, p. 110, pl. VIII, fig. 2. [♀; Gatun, Canal Zone, Panama.]

I have no information to add to Hebard's original description of this most striking species. The original illustration shows the type somewhat too broad, as the photographs of the type here reproduced show. The type and paratype, in the Hebard Collection, are now before me. No other material is available or has been collected as far I am aware.

RHCNODERMA Gerstaecker

1889. *Rhcnoderma* Gerstaecker, Mitth. Naturwiss. Ver. Neu-Vorpomm. und Rügen, Greifswald, XX, p. 28.

1905. *Rhcnoderma* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 414.

1907. *Rhcnoderma* Bruner, Biol. Cent.-Amer., Orth., II, pp. 212, 247.

Genotype (by monotypy).—*R. olivaceum* Gerstaecker.

While Bruner placed five species under this genus, and Hebard subsequently added another, with the type material of all six before me, I am able to state definitely but four species are represented by the material on which the names were based. The species described by Hebard, i.e. *magnificum*,⁸ is here removed to a distinct and well-marked genus (*Panamacris*), while two of Bruner's species prove to be synonyms.

Generic features.—Apterous; form stout, venter subconcave, head broad, cephalic and median limbs short; surface largely impresso-punctate to punctate or rugulose, cephalic and median limbs and caudal tibiae and tarsi markedly pilose. Head short and broad; face flattened and subvertical; fastigium strongly declivent, passing into frontal costa with or without a transverse angulate delimiting low carinula, paired supra-antennal, juxta-ocellar tubercles present or absent; frontal costa subquadrate dorsad, with a transverse inter-antennal carinula at or immediately dorsad of median ocellus, briefly ventrad of this point the costa is sharply narrowed and may or may not become obsolete before reaching the clypeal suture; supplementary (lateral) facial carinae present in variable emphasis: antennae with 23 articles. Pronotum abbreviate, broader than long in dorsal aspect, subsellate but not concave dorsad; cephalic margin weakly to definitely emarginate with subobsolete to definite lateral bounding angles; caudal margin subtruncate dorsad; transverse sulci three or four in number, the cephalic one interrupted mesad; median carina obsolete or indicated by separated cristulate nodes; metazona never more, usually less, than a third the prozonal length: lateral lobes subquadrate. Prosternal process transverse, in basal form rectangulate, surface transversely low tectate; mesosternal lobes with interspace narrowly (δ) to markedly (σ) transverse, its surface bearing mesad a deep circular pore-like foramen; metasternal lobes subcontiguous to contiguous. No external auditory foramina evident. Cerei simple and styliform; ultimate sternite (subgenital plate) of male compresso-rostrate, slightly to very decidedly surpassing apex of ultimate tergite (supra-anal plate); ultimate sternite (subgenital plate) of female produced mesad in aciculate process. Cephalic femora and tibiae short and stout, the former deplanate ventrad and both subdepressed; median limbs compressed; caudal femora compressed, dorsal margin serrulate to variable degrees, ventral margin entire; caudal tibiae with 7 to 8 external spines, one of which is apical, and 9 to 14 internal spines; caudal tarsi slender, second article but slightly, if at all, shorter than proximal article, latter subequal in length to distal one.

Distribution.—The genus *Rhcnoderma* ranges from the Chiriqui region of western Panama northward across western Costa Rica and Honduras to as far as Acapulco in Guerrero, Yucatan and the state of Vera Cruz, Mexico. One subgenus also occurs in northern Honduras.

⁸ Trans. Amer. Entom. Soc., L, p. 110, pl. VIII, fig. 2, (1924). [δ ; Gatun, Canal Zone, Panama.]

Subgenera.—Two definite divisions are evident in the genus, which I am according the rank of subgenera, although the extreme conditions of each are markedly divergent. The future may show the desirability of according generic rank to these, but without a larger series of adult material I prefer to treat them as subgenera.

Key to Subgenera and Species

1. Median carina of pronotum obsolete.⁹ Cephalic margin of pronotum with median emargination weak or subobsolete, bordering points not marked. Ultimate sternite (subgenital plate) of male less strongly rostrate. (*Rhcnoderma*, s.s.) 2
- Median carina of pronotum represented by one or more linearly disposed, elevated nodes. Cephalic margin of pronotum distinctly emarginate mesad, flanked by marked but blunt points. Ultimate sternite (subgenital plate) of male acuminate rostrate. (*Lempira*, new subgenus) 4
2. Head proportionately broader. Frontal costa obsolete ventrad of inter-antennal impression. Pronotal episternum briefly acute-produced, extending slightly cephalad of cephalic margin of adjacent lateral lobes. Ultimate tergite (supra-anal plate) of male with its distal extremity linguiform produced, the whole exceeding in length the exposed section of preceding tergite. (Chiriqui, Panama and western Costa Rica.)*olivaceum* Gerstaecker
- Head proportionately narrower. Frontal costa continued ventrad of inter-antennal impression. Pronotal episternum rectangulate, not produced or extending cephalad of cephalic margin of adjacent lateral lobes. Ultimate tergite (supra-anal plate) of male trigonal, not exceeding in length the exposed section of preceding tergite 3
3. Body punctations more thickly, generally and deeply impressed. Fastigium of vertex lacking a distinct median carinula. Median femora of male less strongly arcuate when seen in cephalic aspect. Ultimate tergite (supra-anal plate) of female slightly longer mesad than proximal width; cerci of female longer, more slender. (Western Costa Rica.)*humile* Rehn
- Body punctations less thickly, generally and deeply impressed. Fastigium of vertex with a distinct median carinula. Median femora of male more strongly arcuate when seen in cephalic aspect. Ultimate tergite (supra-anal plate) of female with median length and proximal width subequal; cerci of female shorter, stouter and less attenuate. (Southern Mexico and Yucatan.)*basale* Bruner
4. Dorsal protuberances of median line of pronotum lower, less evident; black-tipped points of caudal margin of pronotum larger. Femora

⁹ The female type of *Rhcnoderma olivaceum* Gerstaecker has two very low, sub-circular nodules placed on the median line of the pronotum, one near the cephalic third, the other at the caudal third. These, however, are not the linear type of nodes seen in the same sex in the subgenus *Lempira*, apparently being an individual feature, and between them is no indication of a subtectate carinula, as in the females of *R. (L.) arcanum*. No other specimen of true *Rhcnoderma* seen has the same nodules present.

—particularly cephalic and median pairs—somewhat longer and less robust. Metasternum broader caudad. Median process of caudal margin of ultimate sternite (subgenital plate) less aciculate. (Northern Honduras.) *archimimus*, new species
 Dorsal protuberances of median line of pronotum higher, more evident, subtriangular; black-tipped points of caudal margin of pronotum smaller. Femora—particularly cephalic and median pairs—somewhat shorter and proportionately more robust. Metasternum narrower caudad. Median process of caudal margin of ultimate sternite (subgenital plate) more produced aciculate. (Southern Honduras.)
arcanum, new species

Subgenus RHICNODERMA, s.s.

As has been pointed out in the preceding key to the subgenera of *Rhcnoderma*, the species included in the restricted typical subgenus can be distinguished from those of the subgenus *Lempira* by the median carina of the pronotum being virtually lacking, the cephalic margin of the pronotum having the median emargination, which is very definite in *Lempira*, weak or even subobsolete, with the bordering points not marked, while the ultimate sternite (subgenital plate) of the male sex is less strongly rostrate.

The restricted subgenus is divisible into two groups, one including only the genotypic species (*olivaceum*), the other embracing *humile* and *basale*, the latter of which may eventually prove to be but a geographic race of *humile*.

Distribution.—As far as present information goes restricted *Rhcnoderma* occurs in Yucatan, southern Mexico, western Costa Rica and western Panama. The apparent break in its distribution, i.e., its absence from Honduras and Guatemala, as well as Nicaragua, I feel, is due merely to the incompleteness of our information from those countries. Whether the subgenus, or for that matter the genus, occurs south of the Isthmus of Panama remains for future investigations to determine.

Rhcnoderma olivaceum Gerstaecker. Text-fig. 11; plate 3, fig. 16; pl. 4, figs. 17-19.

1889. *Rhcnoderma olivacea* Gerstaecker, Mitth. Naturw. Ver. Neu-Vorpomm. und Rügen, Greifswald, XX, p. 29. [♀ [sex not stated]; Chiriqui (Panama).]

1908. *Rhcnoderma glabra* Bruner, Biol. Cent.-Amer., Orth., II, pp. 248, 249. [♀; Pozo Azul, Costa Rica.]

Type material.—I have before me, through the courtesy of the authorities of the Museum of the University of Greifswald, the unique (female) type of Gerstaecker's *olivacea* (= *olivaceum*), and also, from the Hebard Collection, the female type¹⁰ and a paratype of the same sex, comprising all the original material of Bruner's *glabra*. These specimens show conclusively that the two names were based on the same species. Bruner erred in not comparing his species with Gerstaecker's genotype, instead briefly pointing

¹⁰ Selected by Rehn and Hebard, Proc. Acad. Nat. Sci., Phila., 1912, p. 119, (1912).

out a few features separating it from his *basalis* (= *basale*), which is a quite different species. The key to the species of *Rhcnoderma* presented in the "Biologia" is valueless, as while Bruner recognized five species in the genus, the material before him at that time represented but two. In the present study I have examined all the (four) specimens studied by him. The key in question was based on size, which the present material shows has but limited value, body punctations, similarly in large part of limited application, and color, which is almost useless as a species criterion in the genus. His *basalis* (= *basale*) and *pugnax*, which are sexes of the same species, were placed in different sections of the key, as were also *glabra* and *olivacea* (= *olivaceum*), which are synonymous and in addition based on the same sex.

The type of *olivaceum* is in fair condition, lacking only antennae, the entire right caudal tarsus and the distal article and claws of all the left tarsi. The color has been well preserved. The label reads "*Rhcnoderma olivacea*. Chiriqui." The type of *glabra* lacks most of the antennae, the right front limb and the right caudal tarsus, while the left median tarsus is incomplete. The paratype of *glabra* lacks the antennae and the caudal limbs. Both specimens of *glabra* are labelled "Pozo Azul", but the collectors—said in the description to be Underwood and Carriker—are not specified. The type of *glabra* is now Hebard Collection No. 305.

Specific variation.—The original description given by Gerstaecker, supplemented by Bruner's characterization of the same sex in his description of *glabra*, is sufficiently ample, when taken with the present key and illustrations, to make a new full description of the female sex unnecessary. Below I am briefly describing the male sex, from the here indicated allotype.

Gerstaecker's description of the generic structural features is drawn entirely from his species, and further from the type specimen of the present form, which is now before me. It is evident he erred seriously in saying the unpaired (median) ocellus was "ganz verkümmert". While this organ is less evident in his type than in the other females, it will be found present as a transversely elliptical structure, taking up almost the entire rectangulate transverse area between the ventral halves of the antennal bases. It is more circular in the male than in the female, and slightly more definitely emphasized.

Certain features have been over-emphasized by Gerstaecker in his generic description, as the material now before me indicates. The so-called pronotal tubercles are really quite low in the type, and the present series shows they are not a stable character, being almost obsolete in the other females of the species. Similarly the median emargination of the cephalic margin of the pronotum, which is stressed by him and but moderately evident in the type, is much less definite in the other specimens.

The coloration described by Bruner is, I feel, truer to that of nature than Gerstaecker's, judging from the male before me, which has had its color most carefully preserved, except for one feature noted in its description.

The number of spines on the external margin of the caudal tibiae ranges from seven to eight, of the internal one from nine to eleven.

Allotype.—♂; Pozo Azul de Pirris, western Costa Rica. Elevation 325-400 feet. August 21, 1927. (Lankester and Rehn; on foliage along edge of clearing in forest.) [Academy of Natural Sciences of Philadelphia.]

Size distinctly smaller than in female;¹¹ general form similar but slightly more slender; surface with impressed cribroso-punctations of face, genae, pronotum, mesonotum, metanotum, mesopleura and metapleura distinct and closely placed as in female, occiput and postocular portions of head with less definite and fewer punctations, abdomen with puncta progressively less distinct caudad, venter as in female.

Head as seen in cephalic aspect with occipital line less strongly arcuate transversely, the inter-ocular space narrower, not greater than one-third total width across genae, instead of two-fifths of same as in the female, this interval equal to the distance between the axes of the antennal insertions, rather than that between the external margins of the scrobes as in the female; in profile the paired ocelli are more prominent and seen to be placed on a line with the middle of the eye depth, instead of appreciably below that point as in the female; characteristic design of fastigial structure as in female but narrower, particularly the interantennal constriction; median ocellus distinct, transverse, ovate instead of elliptical as in female, placed between the ventral halves of the antennal scrobes; frontal costa obsolete ventral of median ocellus; eyes slightly more prominent than in female, their axes more nearly approaching the vertical: antennae subequal in length to head and thoracic segments combined, made up of twenty-three articles, rather heavy.

Pronotum much as in female, less markedly selliform, three transverse sulci deeply impressed laterad, the second one complete, the others incomplete, across the dorsum; no median carina indicated; lateral lobes slightly shallower than in male, length of same but slightly less than depth, ventral margin somewhat more strongly sigmoid. Mesonotum and metanotum and their respective pleura as in female.

Penultimate abdominal tergite transverse, as seen from dorsum hexagonal, the three more cephalic borders subequal in length, each virtually straight, the caudal border broad and shallowly concave, caudo-lateral borders very short, straight, converging caudad, continuous in trend with adjacent margins of ultimate tergite; latter (supra-anal plate) appreciably longer than broad, the lateral margins evenly converging and straight oblique in proximal half, distal half of tergite linguiform, apex narrowly rounded, dorsal surface of ultimate tergite shallowly excavate in distal half. Cerci styliform, tapering, subacute apices faintly bent inwards, reaching to distal third of ultimate tergite. Ultimate sternite (subgenital plate) seen

¹¹ Comparisons with the female sex have all been made with the female type of *glabra*, which is more nearly perfect than the other females of the species now available.

from above acuminate, decidedly compressed; in profile with apex moderately acute, a marked medio-longitudinal carina present on ventral line, and continued on most of the preceding sternite; dorso-lateral margins of ultimate sternite moderately convex when seen in profile.

Prosternum transversely carinate, with lateral tubercles as in male; mesosternal lobes with median interspace slightly broader than deep; metasternal lobes contiguous.

Limbs as in female.

Color Notes.—As a whole buffy citrine (Ridgway), probably more vividly greenish in life; caudal femora oil yellow, genicular arches washed with brussels brown, the dorsal surface of the genicular regions faintly tinted with same; caudal tibiae and tarsi vinaceous-tawny, spines of internal series of tibiae wholly black, of external series black tipped; antennae distad of, and including, third article deep fuscous; eyes prout's brown; lines of contact of mesonotum and metanotum, metanotum and proximal abdominal tergite and of first and second abdominal tergites heavily pencilled with fuscous, distal margin of second to eighth tergites of abdomen definitely pencilled transversely with same. In life this specimen had the mesopleural and metapleural episterna each strikingly and completely marked with white. These areas in the dried specimen show but little evidence of this coloration, but notes made at the time of capture state they were very conspicuous.

MEASUREMENTS (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of caudal femur
♂, Pozo Azul, <i>allotype</i>	33	4.1	6.8	17
♀, " " <i>type of glabra</i>	51	5.9	9.4	21.8
♀, " " <i>paratype of glabra</i> ...	46 ¹²	6.3	10.2	— ¹³
♀, Chiriqui, <i>type</i>	41	5.5	9	20.2

Distribution.—Known only from the district of Chiriqui, western Panama, and from Pozo Azul in the Pirrís plain along the Rio Pirrís, in western Costa Rica.

Biological Notes.—Nothing is known as to the date or the exact locality at which Gerstaecker's type was taken and in consequence it can furnish us with no clue as to the habitat or season of the species. The locality from which came Bruner's material of *glabra* (Pozo Azul de Pirrís) is in an area of heavy forest which covers the plains (Llanos) of the lower Rio Pirrís, a quite-different type of country from the Guanacaste country to the north-west, or the savanna of most of coastal Panama to the southeast and east. I visited the locality in 1927, especially to get material of this and many

¹² Abdomen less extended than in type of *glabra*.

¹³ Caudal limbs lacking.

other species described by Bruner or by me from material collected there in previous years by Carriker or Underwood. A description of this work and the character of the Pozo Azul forest has already been published and the interested student is referred to it.¹⁴ Unfortunately, we have no habitat data accompanying the original material of *glabra* and our entire knowledge of the species' habits is that the allotype was swept August 21 from forest foliage bordering a small clearing at Pozo Azul. In all probability the species is a vine frequenter, but I have no positive evidence and the sweeping which netted it was not limited to a single element of the foliage.

In Costa Rica *olivaceum* is thus known only from country quite low and not far from sea-level, but as the hills rise immediately to the north of Pozo Azul one cannot say the species is limited to the lowest elevations. However, it is apparently replaced in Guanacaste to the northward by *R. humile*.

Specimens examined: 4; 1 ♂, 3 ♀.

Chiriqui, Panama; 1 ♀ (*type*); [Greifswald Mus.].

Pozo Azul de Pirris, Costa Rica; 2 ♀ (one *type*, one *paratype* of *glabra*); [Hebard Collection]: August 21, 1927; (Lankester and Rehn); 1 ♂ (*allotype*), [A. N. S. P.].

Rhcnoderma humile Rehn. Plate 4, figs. 20 and 21; pl. 5, fig. 28.

1905. *Rhcnoderma humile* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 415, figs. 15 and 16. [♀; Tarbaca, Costa Rica.]

The type from the Academy collection is now before me. It lacks part of one antennae, the median right tarsus and portions of the cephalic and caudal left tarsi. It is somewhat smaller than the other females now in hand, but as there is no other adult material from Tarbaca, the type locality, or adjacent localities, this may be a local or environmental tendency.

The original description sets forth the salient features of the species which is quite distinct from *R. olivaceum* Gerstaecker, but quite close to *R. basale* Bruner, which latter may prove, when more extensive series from intervening localities are available, to be merely a more northern geographic race of *humile*.

As the male sex has not been described the following noteworthy features of that sex, as compared with the female, should be of service.

Allotype.—♂; Chará (i.e. San Lucas Island),¹⁵ Gulf of Nicoya, Costa Rica. November 23, 1915. (Anastasio Alfaro.) [Academy of Natural Sciences of Philadelphia.]

¹⁴ Year Book Acad. Nat. Sci. Phila., 1927, pp. 32-34.

¹⁵ My long-time friend Prof. Anastasio Alfaro, of San José, Costa Rica, informs me that the name Chará is the Chorotega Indian name for San Lucas Island in the Gulf of Nicoya. The name was also used for the beautiful long-tailed jay *Calocitta formosa*, which is a dominant feature of the west coast of Central America.

General form, surface texture and vesture as in female.

Occiput slightly lower and less strongly arcuate transversely than in female; fastigial and facial sculpture as in female except that the transverse, sub-bilobate impressed area between the antennae is less strongly transverse.

Pronotum with lateral lobes more quadrate than in female, their width not greatly exceeded by their depth from median line, caudal margin of lobes more distinctly convex than in female. Meso- and metanota and their respective pleura as in female.

Abdomen less definitely compressed and less strongly medio-longitudinally carinate than in the female: penultimate abdominal tergite as in female, moderately transverse, distal margin shallowly concave; ultimate tergite (supra-anal plate) trigonally linguiform, apex narrowly acute, median length but slightly greater than proximal width; surface of median distal area shallowly concave, lateral portions proximad moderately deflexed; ultimate sternite (subgenital plate) quite strongly compressed, narrow, in profile outline acute semi-elliptical, surface rugulose, a definite ventral medio-longitudinal carinula evident, continued on distal part of penultimate sternite; cerci styliform, tapering, reaching distad virtually to apex of ultimate tergite.

Limbs essentially as in female.

MEASUREMENTS (in millimeters)

The Chará measurements here given represent the extremes of the series of twelve adults from that locality.

	Length of body	Length of pronotum	Greatest width of pronotum	Length of caudal femur
♂, Chará, <i>allotype</i>	34.2	5.4	7.8	18
♂, Chará	30	4.5	6.9	16
♂, Oricuajo	30.8	4.6	6.5	15.7
♀, Tarbaca, <i>type</i>	32	4.7	6.7	14.5
♀, Chará	33.3	5.3	7.4	16.8
♀, Chará	37.5	6.4	8.1	18.7

It is evident from the above figures that both sexes of *humile* show a very definite amount of size variation at a single locality, while in addition there may be some regional fluctuations, but on this point the available material is insufficient for any conclusive deductions.

Color notes.—The series of adults of this species now before me, the largest available as far as known of any American member of the Euthymiae, shows that the male sex is always more greenish yellow and less olivaceous than the female. The general tone in the male ranges from as light as olive-ocher or honey yellow (in allotype) to as dull as light brownish olive, the latter extreme, however, in but a single specimen, the majority being nearer ecru-olive. The Oricuajo adult male has the proximal abdominal tergite appreciably apricot yellow, which in the fresh specimen was even more strikingly contrasted. This to a less decided extent is also indicated on the second tergite. The females range in general tone from

as light as pale ochraceous-tawny to as dull as raw umber. One female from Chará is quite generally but not strongly mottled with raw umber on an ochraceous-tawny ground. Another female shows faint traces of this condition, but chiefly on the pronotum. The immature female Chará specimens (two) are finely mottled with raw umber on a paler ground, one more so than the other, while both have the tergites' caudal margins and less completely those of the thoracic nota regularly beaded with fuscous.

The caudal femora are sulphine yellow to pyrite yellow in all the males, the genicular arches cinnamon-rufous, pencilled above, below and across the base of the external genicular lobe and washed over the whole internal genicular area with blackish fuscous. The caudal tibiae of the male range from rufous, through flesh-ocher to apricot-buff, occasionally the flexor surface paler than the extensor, the spines fuscous tipped in external series, lined with same in internal series, caudal tarsi almost entirely scarlet-red, rarely paling to jasper red. In the females the femora are duller, the external surface either agreeing with the general tone or cinnamon with the genicular pattern similar to but less emphasized than in the male, the internal face, however, aside from the dark genicular extremity, and the ventral sulcus are solidly dark, ranging from mars brown to mummy brown.

The abdominal banding, i.e. the transverse dark margins to most of the tergites, is evident in all the males, but not as apparent and even subobsolete in the female sex. The dark transverse line at the juncture of the proximal and second abdominal tergites is evident in all the adults, but more pronounced in the males. The latter sex has the lining also present at the caudal margin of the mesonotum and metanotum.

Morphological notes.—With but a limited series of this species available—yet probably the largest known of any American member of the Euthymiae—it is evident there is appreciable intra-specific plasticity in certain structural features. There is some fluctuation in the emphasis of the fastigial bordering carina, and also in the exact amount of excavation of the infra-antennal sections of the face, and these are seen to occur in material of the same sex. Similarly, regardless of sex, there is variation in the depth of emphasis and relative completeness of the dorsal sections of the transverse sulci of the pronotum. Occasionally four are indicated with the most cephalic alone broken mesad, again the second and fourth are subobsolete, very rarely all but the third are but poorly defined on the dorsum. All these types are to be found in Chará individuals taken the same day.

The number of external spines on the caudal tibiae ranges in the males from 7 to 9 (the average 8 with 7 on one and 9 on another, the other leg in each case with 8), and in the females from 8 to 9 (the latter in but one, which has 8 on the other tibia). The number of internal spines on the

caudal tibiae ranges from 10 to 11 in the male, nearly equally divided, while the females all have 10.

Distribution.—The valley of the Rio Grande de Tárcos and adjacent areas of western and west-central Costa Rica, and at least the island of Chará (San Lucas) of those in the Gulf of Nicoya, constitute the habitat of this species, the area of distribution extending from sea-level on San Lucas (Chará), and near the same at Oricuajo (225 feet),¹⁶ eastward to at high as Aserri, at an elevation of 4400 feet. It does not seem to cross the mountain barrier to the south, separating the Tárcos drainage from the Rio Candelaria and the Rio Grande de Pirris, in the lower levels of which latter *R. olivaceum* occurs. While *humile* ranges into the upper tributaries of the Rio Grande de Tárcos, such as the Rio Maria Aguilar, it does not cross the Continental Divide, and the genus is not known from the Atlantic slope of Costa Rica.

Biological notes.—Past literature furnishes nothing as to the habits of this species. The notes I made at the time portions of the series here recorded were taken are all the available information. These show that on the Rio Maria Aguilar it was swept from foliage of low trees along the river, at Aserri it was beaten from vine tangles on a cut bank along a road in coffee areas, while at Oricuajo it was found either on the leaves or sitting along the stems of heliconias growing on the edge of a forest clump in a predominately savanna-like country.¹⁷ None of the localities from which *humile* is known is one of dense, continuous forest and the species is probably not present in conditions of this type. It is definitely a vine or heliconia-inhabiting species, a type of environment which in its territory borders scattered forest patches, thickets, and screen-like riverine tangles.

Apparently the species becomes adult in early September, as all taken before that date are immature, and the series from Chará (San Lucas Island), which also includes several immature specimens, was taken November 23rd. The type was taken in December, thus giving us a range for the adult condition from September 2 (Oricuajo) to December (Tarbaca). The immature individuals taken September 2 (Oricuajo) represent the two instars preceding maturity, while those taken November 23 (Chará) apparently represent only that immediately preceding the imagal condition. Those taken in August represent, in both cases, distinctly less advanced instars.

Specimens examined: 21; 8 ♂, 6 ♀, 2 immature ♂, 5 immature ♀.

Aserri, Costa Rica, elev. 4400 feet; August 5, 1927; (Rehn); 1 immat. ♂.

¹⁶ Oricuajo is a small hamlet of a few houses on the Pacific Railroad at the crossing of the Rio Jesús Maria, about five kilometers in an air-line from the river mouth at Tivives, and about twenty-odd kilometers by rail east of Puntarenas. The Rio Machuca joins the Rio Jesús Maria at Oricuajo.

¹⁷ See Rehn, Year Book Acad. Nat. Sci. Phila., 1927, pp. 34-35, (1927).

Rio Maria Aguilar, near San José, Costa Rica, elev. 3620 feet; August 30, 1923; (Tristán and Rehn); 1 immat. ♀.

Tarabaca, Costa Rica; December, 1902; (C. F. Underwood); 1 ♀ (*type*).

Chará (San Lucas Island), Gulf of Nicoya, Costa Rica; November 23, 1915; (A. Alfaro); 7 ♂, 5 ♀, 1 immat. ♂, 2 immat. ♀.

Oricuajo, Costa Rica, elev. 225-250 feet; September 2, 1927; (Tristán and Rehn); 1 ♂, 2 immat. ♀.

Rhcnoderma basale Bruner.

1907. *Aristia megacephala* Bruner, Biol. Cent.-Amer. Orth., II, pl. 3, figs. 21, 21a-d. (Not of Bruner and Stål.) [Name on plate only.]

1907. *Rhcnoderma basalis* Bruner, Idem, p. 248. [♀; [Tehuantepec,] Mexico.]

1907. *Rhcnoderma pugnax* Bruner, Idem, pp. 248, 249. [♂; Vera Cruz, Mexico.]

On one of the plates accompanying Bruner's text on the Acrididae of the "Biologia" he has given five figures of the male of the present form on which he, probably at a subsequent writing, based the name *Rhcnoderma pugnax*. This specimen is now before me. Unfortunately Bruner used for this insect, in the explanation at the bottom of the plate, the name *Aristia megacephala*, presumably intending Bruner's *Pezotettix megacephala*, described in 1861 and referred to *Aristia* by Stål in 1878. An explanatory note on page 342 of Bruner's study gives the correlation of the name used on the plate with *Rhcnoderma pugnax*. It was customary to prepare the plates of the "Biologia" some time in advance of the completion of the text, and name discrepancies are often encountered, occasionally raising questions as to the probable priority of the names given on the plates over those in the text. Unfortunately the usual destruction of the parts covers by librarians, when the respective folios were assembled by subjects from the varied components making up each part, removed the one means of determining whether priority existed. The folios of text are each dated, but the plates are not, and the sole clue as to their dates of issue was on the first page of the folded paper cover which enclosed each distribution of assorted text and plates.

Type material.—The unique type of *Rhcnoderma basalis* Bruner, in the Museum of Comparative Zoölogy, lacks one antenna and the distal half of the other, as well as the left caudal limb. As Bruner remarked it is labelled "Palmer's assorting No. 1155", but unfortunately he failed to note what the Museum records show, i.e., that Palmer's No. 1155 specifically referred to material taken at Tehuantepec, Mexico, by Sumichrast. Instead he sweepingly states, "Other numbers of his assorting, ranging from 1148 to 1166, refer to Yucatan, Tehuantepec, and neighboring localities."

The unique type of *R. pugnax* Bruner is contained in the Hebard Collection, being type no. 306. It was taken by the Rev. T. Heyde in January, 1892, and is labelled "Vera Cruz, Mexico." Whether it was taken actually

at the city of Vera Cruz or this relates to the state of the same name I am unable to say.

The types on which the names *basalis* and *pugnax* were based have been physically compared on a recent visit to Cambridge, and it is clearly evident they represent sexes of the same species, the supposed differences, which were greatly overstressed, being merely either sexual or individual variations in surface sculpture. With a fair series of *R. humile* from a single locality available to judge the degree of fluctuations found within a species of the genus, it is evident that the two supposedly distinct Mexican species are synonymous.

The type of *basale* has clearly been dried after alcoholic or other wet preparation, the eyes showing this by their rather shrivelled condition. The infuscation of the "sutures of all the abdominal segments", mentioned by Bruner, is really little evident and no more than we find in *R. humile*. It is, in fact, less evident than in the type of *pugnax*.

Comparison.—The species *basale* is a northern representative of the *humile* stock, and may, when material from intermediate areas has been secured and examined, prove to be merely a geographic race, intergrading southward into *humile*. If such should prove to be the case the name *humile*, being the older, would be used for the species and *basale* coupled with it in a subspecific sense.

In the key to the species of the genus, I have given what appear to me to be the only features of value to separate *basale* from *humile*. Others have been noted which I feel may not be as constant, although with but two adults of *basale* available no final conclusions can be drawn.

When the sexes of *basale* are compared much the same differences are found as is noticed in *R. humile*. The female is, as a whole, more robust, the surface relatively less glabrous and more deeply impresso-punctate, while the fastigium and frontal costa are broader.

Measurements.—The male (i.e. type of *pugnax*) has the total body length, 32 mm.; length of pronotum, 4.6; greatest width of pronotum, 6; length of caudal femur, 15.2. The female (type) has the abdomen distorted, and measured around the curvature we have a length of 51 mm.;¹⁸ length of pronotum, 7; greatest width of pronotum, 8.5; length of caudal femur, 21.

Color notes.—The following color description was made from the female type. General color dull olivaceous-green on head and thoracic nota, the head somewhat paler, on the genae approaching dull ochraceous-buff, the cephalic margin of the lateral lobes bordered with same. Proximal abdominal segment dull ochraceous-buff; remainder of abdomen (probably

¹⁸ Bruner gave 47 mm. as the length, which was evidently a straight line measurement between extreme points, distortion disregarded. The normal length in life was, probably, between the two here given.

discolored by preservation and subsequent dessication) olivaceous-brown, the second tergite narrowly bordered proximad and the metanotum distad with blackish fuscous; ovipositor jaws largely fuscous, dorsal valves with dorsal surface, except for fuscous pencilled markings, light buff, proximo-lateral areas of ventral valves dull buff. Cephalic and median limbs olivaceous; caudal femora rather pale olive-green, principal carinae strongly, and paginal pattern weakly, pencilled with prout's brown to sayal brown, ventral surface quite pale olivaceous; genicular arches, most of lobes and much of dorsal surface of genicular extremity blackish fuscous; caudal tibiae solidly blackish fuscous, except that the external section of the extensor surface is lined with pale olivaceous, darkening proximad; caudal tarsi pale olivaceous, infusate distad and on ventral surface. Sterna pale olivaceous green. Eyes brownish (discolored?).

The male agrees with the above color description of the female except that the head is somewhat more ochraceous-buff as a whole, with traces of postocular fuscous bars, while the clearly discolored abdomen shows less color contrast than in the type. The caudal femora lack any pencilled paginal pattern and the blackish fuscous of the genicular area is almost wholly on the genicular arches. The caudal tibiae are dull purplish internally, dragon's-blood red externally, the tarsi jasper red.

Distribution.—This species is known from but three localities in southern Mexico, viz, Tehuantepec, Vera Cruz, and Acapulco in Guerrero, and one in Yucatan (i.e. Chichen Itza). Whether Tehuantepec refers specifically to the settlement of that name, or to the Isthmus on the southern border of which the town is situated, is not known, neither can we say whether the state of Vera Cruz or the city of that name was intended. In the case of Acapulco we have a recently collected, although unfortunately immature, individual, and the same is true of that from Chichen Itza, Yucatan. Very probably the genus ranges northwestward to at least the hot valley of the Rio Balsas northwest of Acapulco. What may be the extent of its range in eastern Mexico is conjectural. It most certainly does not occur on the southern end of the Mexican Plateau and any northward extensions would be to the east or west of that great physiographic barrier. The only exact altitudinal information we have as to the species' occurrence is of its presence at sea-level at Acapulco, and but slightly above this at Chichen Itza.

Biological notes.—The only capture dates we possess for this species are that the male (type of *pugnax*) was taken in January; the Acapulco individual, which is probably in the second instar preceding maturity, was captured August 11, and that from Chichen Itza, which can hardly be more mature than the third instar preceding maturity, was taken June 8. From this meager information one may assume that its seasonal appearance is

much the same as that of *R. humile*, i.e. not becoming adult until Autumn or early winter.

Specimens examined: 4; 1 ♂, 1 ♀, 1 immature ♂, 1 immature ♀.

Vera Cruz, Mexico; January, 1892; (Heyde); 1 ♂ (type of *R. pugnax*); [Hebard Cln.].

Tehuantepec, Mexico; (Sumichrast); 1 ♀ (type of *R. basalis*); [M.C.Z.].

Acapulco, Guerrero, Mexico; August 11, 1935; (H. Radclyffe Roberts); 1 immature ♀.

Xtolok Cenote, Chichen Itza, Yucatan; June 8, 1932; (E. P. Creaser); 1 immature ♂; [Mus. Univ. Michigan].

Subgenus LEMPIRA,¹⁹ new subgenus

Genotype.—*Rhcnoderma* (*Lempira*) *archimimus*, new species.

This subgenus is erected to include two Honduranian species which, while apparently congeneric with *R. olivaceum*, the genotype of *Rhcnoderma*, agree in possessing certain features in common not characteristic of the restricted typical subgenus. These have been summarized in the preceding key to the subgenera and species and are here stated in greater detail.

Subgeneric features.—Pronotum with median carina represented by separated, linearly disposed cristulate nodes; cephalic margin of pronotum mesad definitely concavo-emarginate, lateral delimiting angles definite, obtuse, their surface sub-strumose and elevated. Dorsal surface of abdomen with numerous symmetrically but irregularly disposed sinuate sublongitudinal rugulae; ultimate sternite (subgenital plate) of male markedly and acuminately rostrate produced.

Distribution.—Northern and south-central Honduras.

Remarks.—It is unfortunate that more fully adult material of the species here referred to the subgenus *Lempira* is not available. I am fully convinced of the cohesive character and taxonomic worth of the group as one meriting a name, but naturally could wish for a broader opportunity to weigh the features considered diagnostic of the subgenus. To fail to separate these species from restricted *Rhcnoderma* would do violence to conclusions drawn from the study of the group as a whole, and it is hoped further material may soon be available.

The two species here placed in the subgenus *Lempira* show in a number of features a tendency away from restricted *Rhcnoderma* toward the genus *Cristobalina*, described on a subsequent page.

¹⁹ Lempira was the chief of the Chontal Indians, who offered determined resistance to the Spanish conquistadors.

Rhcnoderma (Lempira) archimimus²⁰ new species. Text-fig. 12; plate 4, fig. 22; pl. 5, figs. 23-25 and 29.

In the key to the species I have given the essential features to separate this from the closely related *R. (L.) arcanum*. While this insect has the median carina of the pronotum less elevated and not appreciably subdentate, the general surface is more densely cribroso-punctate and more generally rugulose than in the other species, while the black tipped points on the pronotum, and particularly on its caudal margin, are not only larger but more definitely elevated and subcicatriform. The head is faintly broader than in *arcanum*, but the difference is not readily expressed as a diagnostic feature. The ventral surface of the caudal femora is dark purple in the type and allotype of this species, while in the type and paratype of *arcanum* this area is uniformly pale. However, I have not used certain of these features as diagnostic, preferring to await the acquisition of more extensive and fully mature material of *arcanum*.

Type.—♀; Subirana, Province of Yoro, Honduras. August 11. (Stadelmann.) [Museum of Comparative Zoölogy.]

Size relatively small; form moderately robust, blunt fusiform, apterous; surface cribroso-punctate to rugulose, the dorsum of the abdomen particularly with regular sinuate sublongitudinal rugulae.

Head short and broad, greatest breadth across eyes hardly inferior to the depth of head: occiput low, rounded, little elevated dorsad of eyes, in the interocular section, which is slightly broader than the transverse dimension of the eye as seen from dorsum, with seven distinct but rounded, nodose tubercles, of which one is median, flanked by two pairs, one of them, which is the larger, close to the eye margin, the other cephalomesad of the juxta-ocular one, another, and the most conspicuous pair, is placed immediately cephalad of the secondary pair at the point of least width of the interocular space: fastigium regularly and steeply declivent from the interocular space, in shape transverse, its very definite, juxta-ocular cephalo-lateral angulate angles moderately elevated, the surface of the fastigium shallowly concave, with a subobsolete medio-longitudinal carinula, the surface not separated from and continuous with that of the dorsal section of the frontal costa; dorsal portion of frontal costa quadrate in outline, markedly cut off from the more ventral portions of the costa by the straight transverse carina, lateral margins of the costa here straight and subcarinate, surface of this portion continuously subexcavate with fastigial surface; portion of frontal costa ventrad of transverse carina of the same general shape found in forms of true *Rhcnoderma*, i.e., the lateral margins sharply in-bowed briefly ventrad of the transverse carina, then evenly diverging ventrad to the clypeal suture, the margins continuously indicated and the costa decidedly excavate within them: lateral (supplementary) facial carinae marked, continuous, straight and subparallel: face surface not at all impresso-punctate. Antennae incomplete in type.

²⁰ From ἀρχιμῖμος, i.e. chief of mimic actors, in allusion to the mask-like head and unusual pronotal proportions of most of the Euthymiae.

Eyes moderately prominent, in lateral view with outline ovate, vertical axis inclined slightly ventro-caudad.

Pronotum short and broad, its greatest width across lateral lobes distinctly greater than median length, hardly sellate as dorsal surface is not at all concave: cephalic margin of disk mesad with a very distinct obtuse-angulate emargination, which is flanked laterad by low nodose, equally obtuse marginal productions, around each of which are grouped five or so low nodulose rounded tubercles; caudal margin sinuato-truncate, supplied with regularly spaced nodules, larger on discal section, but continuous over the margin on the lateral lobes and weakly indicated on the ventral margin of the lobes and even ventrad on the cephalic margin of the same: median carina represented by two groups of three nodes, these not high but quite distinct, the largest node situated briefly caudad of the cephalic margin and severing the more cephalic of the transverse sulci, the more caudal group consists of two nodes, one between the second and third transverse sulci, the other, which is more strumose and less nodose, placed between the latter and the caudal margin: three transverse sulci clearly evident, the first broken mesad, the others complete, the metazona on the disk comprising not more than one-fourth the pronotal length: lateral lobes slightly deeper than long, cephalic and caudal margins roughly subparallel, ventral margin sinuate, transverse sulci there well incised, particularly the median; surface of metazona more thickly and cribrately ruguloso-punctate than elsewhere where the sculpture is similar, but coarser and less fundamentally impresso-punctate. Pronotal episternum not projecting cephalad of cephalic margin of pronotum, its cephalic margin subtruncate, with three lobulations.

Mesonotum with caudal margin subtruncate; metanotum with same margin moderately arcuate with a small but sharply-cut median concave emargination.

Abdomen with the sculpture of tergites consisting of sublongitudinally disposed but sinuous, balanced substrumose rugulae: antepenultimate tergite very narrowly exposed, laterad almost completely covered by the preceding one, which has its extreme ventral sections sharply bent at a right angle toward median axis of body, forming a marked though narrow ventral plane to each side of the tergite: penultimate tergite with the median third of its dorsal width cut away so that the base of the ultimate tergite is there subcontiguous with the margin of the antepenultimate, the exposed lateral section of the margin of the penultimate obliquely truncate to the cercal bases, subvertical and straight to their ventral sections which curve under and embrace the bases of the infra-cercal plates: ultimate tergite (supra-anal plate) broad linguiform, subdeplanate, reaching nearly to the apices of the dorsal ovipositor jaws, its greatest length equal to one and one-third times the proximal width of the tergite, proximal two-fifths of its length overlying the remainder of the tergite,²¹ from which it is finely but

²¹ I have considered these to be parts of the same tergite. This divided condition is to be seen in many species of the Cyrtacanthacridinae, sometimes as sharply cut as in the present species and again as clearly merely minor sculptural features of a single tergite. I have endeavored to be consistent in describing the so-called supra-anal plate (or epiproct) as a single tergite, although, as in the present case, it to all appearances is divided in two.

very definitely separated by a transverse truncate ledge-like border, the lateral margins of the more proximal section obliquely straight converging, its surface with median third subdeplanate, the lateral thirds weakly declivent laterad; distal portion of tergite semi-elliptical in outline, faintly narrowing toward apex, surface deplanate except for a shallow medio-longitudinal concavity in distal half: cerci equal in length to proximal portion of ultimate tergite, styliform regularly tapering. Ovipositor valves moderately stout, not markedly attenuate distad, apices in profile blunt acute, seen from dorsum the dorsal valves are apically narrowly rounded, while the dorsal surfaces of the same are concave away from the sublamellate dorso-lateral borders; ventral valves with their ventral surfaces markedly excavate, the lateral borders sublamellate. Ultimate sternite (subgenital plate) with distal margin acutely spicate mesad, the converging lateral portions of this margin weakly sigmoid.

Prosternal process low, in outline as seen from venter transverse rectangulate, its cephalic face subvertical, the bordering rim with two low, transversely disposed, lateral welt-like tuberculations, surface of process caudad of these oblique arcuate declivent to caudal margin. Interspace between mesosternal lobes strongly transverse, its width almost twice its length, internal margins of mesosternal lobes arcuate, passing evenly into the obliquely subtruncate caudal margin of the lobes. Metasternal lobes briefly subcontiguous, the internal margins of the lobes acutely rounded.

Limbs of the type usual in the genus, cephalic femora and tibiae subdeplanate, the median femora and tibiae distinctly compressed, marginal brushes of hairs moderately developed. Caudal femora with their apices falling short of the tip of the abdomen by a distance subequal to the pronotal length, appreciably compressed, their depth equal to one-fourth of their length; dorsal margin weakly and sparsely serrulate, ventral margin entire, pattern of pagina regular; genicular lobes with apex rectangulate, ventral margin of lobes with distal two-thirds oblique subconcave: caudal tibiae but slightly shorter than femora, extensor surface narrow, not at all declivent, distad subconcave longitudinally, external margin with eight spines, one apical, internal margin with thirteen to fourteen spines: caudal tarsi in length equal to slightly more than half that of caudal tibiae, slender, median article faintly shorter than proximal and distal ones.

Allotype.—♂; same data as type. [Museum of Comparative Zoölogy.]

Differing from the description of the type (female) in the following noteworthy features.

Size somewhat smaller; form as in female; surface similarly but less densely rugulose and tuberculations less emphasized than in female, abdominal rugulae having fewer elements evident and these in general more straight oblique.

Head as in female but less strongly transverse: interocular space somewhat narrower, no wider than the distance between the axes of the proximal antennal articles, occipital tubercles situated and developed as in female but less clearly defined; fastigium, frontal costa and lateral (supplementary) facial carinae as in female. Antennae incomplete. Eyes somewhat more prominent than in female.

Pronotum as in female with the following noteworthy exceptions: tubercles associated with the paired productions of the cephalic margin subobsolete except for that immediately laterad of the tubercles: median carina also represented by three nodes, lower than in the female sex, two of these, however, between the first and second transverse sulci, instead of one being caudad of the third, the cephalic tubercle of the series not definitely bisecting the first transverse sulcus; metazona in length hardly more than one-fifth of the total pronotal length; lateral lobes as in female.

Abdomen with the sculpture of dorsum less involved, the elements fewer but somewhat clearer, often straight oblique, convergent caudad; general form of antepenultimate and penultimate tergites as in female, ventral sections of tergite preceding former less sharply bent toward median axis of body: ultimate tergite (supra-anal plate) of the same character and sculpture as in female (type) but its whole outline is sagittate, the margins converging evenly to the acute apex: cerci as in female: ultimate sternite (subgenital plate) distinctly rostrate, acuminate, surpassing the apex of the ultimate tergite by a distance equal to two-thirds the length of the latter, moderately compressed, apex acute, dorsal margins subsigmoid as seen in profile, venter carinate medio-longitudinally.

Prosternal process and interspace of mesosternal lobes as in female, metasternal lobes contiguous caudad.

Caudal femora with their apices reaching to apex of ultimate tergite (supra-anal plate), their depth contained slightly over four and one-half times in their length: caudal tibiae with eight external (one apical) and thirteen internal spines.

Coloration.—General tone of female cinnamon brown, slightly paling on ventral section of lateral lobes of the pronotum to ochraceous-tawny, external surfaces of caudal femora dull ochraceous-salmon, the paginal surface with an olive-buff wash; many tubercles on face, genae, mandibles, the regular, larger pronotal tubercles, similar spaced caudal series on the mesonotum and metanotum, more closely placed and in some cases almost confluent caudal marginal punctae or punctulae on the abdominal tergites and numerous punctae or maculae scattered over all the limbs, fuscous-black or blue-black, the venter less punctate. Internal face of caudal femora black, the dorso-internal face of the external color with three transverse fasciae of madder brown, ventral surface of caudal femora black with a dull longitudinal barring of violet carmine along the ventro-internal carina; caudal tibiae with external face colored as on femora, internal and flexor faces violet carmine, all spines black tipped; caudal tarsi colored like external surface of caudal tibiae. Antennae mars brown, mottled with fuscous. Eyes mingled prout's brown and fuscous.

Male in general snuff brown with a tawny-olive tinge, the occiput approaching light brownish olive, the genae nearer clay color, while pale bars of antimony yellow obliquely cross the lateral lobes of the pronotum, the ventral border of these extending from the ventro-cephalic angle of the lobes to the caudal margin adjacent to the lateral border of the mesonotum, the bars relieved ventrad by a subobsolete pencilling of fuscous and dorsad by a median blotch of the same: caudal femora honey yellow, the details of all the limbs as in the female, the general punctate pattern otherwise essentially as in the female except that the caudal margin of the

pronotum lacks punctae in the pale areas and the abdomen has less emphasis to the marginal beading of the tergites; caudo-lateral border of mesonotum, touches laterad on the metanotum and a longitudinal sublineate infuscation along the ventro-lateral borders of the abdominal tergites, blackish fuscous, the abdominal bordering broadest proximad, distad becoming little more than a pencilling; ventral surface cinnamon to tawny-olive, distad with abdominal sternites brightened laterad to rufous. Eyes mottled as in female, in part as pale as ochraceous-tawny.

MEASUREMENTS (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of caudal femur
♂, <i>allotype</i>	27.5	3.9	5.7	14.2
♀, <i>type</i>	31.3	4.5	7.1	14.6

In addition to the type and allotype, I have before me three quite immature individuals, taken by me at Lancetilla, near Tela, Department of Atlantida, Honduras, September 1, 4 and 9, 1930, which are tentatively referred to this species. These specimens are in the third or fourth instar preceding maturity, and it is difficult to say with absolute certainty whether they represent *R. (L.) archimimus* or *arcanum*, although the head and pronotal structure seems to approach that of the former more closely. All were beaten from heavy rain-forest foliage, at elevations up to 600 feet above sea-level, two from undergrowth and one from vines growing on the trunk of a tall tree.

Rhcnoderma (Lempira) arcanum,²² new species. Plate 5, figs. 26 and 27.

Under *R. (L.) archimimus* will be found a discussion of the features separating the present species from the first-mentioned one. Unfortunately the few known specimens of *arcanum* are not fully adult, and I have erected a new species on the type, which is in the instar preceding maturity, solely because the differential features are characters which are not liable to be invalidated in the final instar, and the median carinal emphasis, at least, is sufficiently pronounced to indicate a definite line of specific cleavage.

Type.—♀ (Juv.); Cantarranas, Rio Choluteca, Honduras. Elevation, 2200 feet. August 19, 1930. (Honduras Expedition, J. A. G. Rehn; beaten from vine foliage.) [Academy of Natural Sciences of Philadelphia, Type no. 5570.]

The following description is largely comparative with the preceding one of the female sex (type) of *R. (L.) archimimus*.

Size appreciably smaller (due to immaturity?); form much as in *archimimus*; surface less sharply impresso-punctate than in *archimimus*, rugulosity as a whole somewhat more evident, abdomen definitely carinate medio-longitudinally.

²² I. e. *hidden*, in allusion to its preferred habitat in vine tangles.

Head faintly deeper in proportion than in *archimimus*, greatest width across eyes somewhat less than head depth, eyes in cephalic view slightly more prominent: interocular width of occiput slightly broader than in *archimimus*, distinctly greater than the transverse dimension of the eye as seen from dorsum, with seven rounded tubercles as in *archimimus* but these less sharply cut, lower, the more cephalic pair more transversely disposed, the following pair (called "secondary" in *archimimus*) much less evident than in the other species: fastigium as in *archimimus* but with its juxta-ocellar angles less sharply developed and subobsolete median carinula indicated, as well as a similarly subobsolete transverse obtuse-angulate carinula separating the fastigium from the frontal costa,²³ which latter is as in *archimimus* but margins less sharply marked; lateral (supplementary) facial carinae less definite than in *archimimus*. Eyes in lateral view with outline more broadly ovate than in *archimimus*. Antennae incomplete.

Pronotum virtually lacking the group of nodes about the paired angles of the cephalic margin of the disk seen in *archimimus*, and with the spaced marginal nodes seen in that species replaced by much more minute nodules of less uniform distribution: median carina represented by three nodes, two of which, the more cephalic and more caudad, placed in the same positions as their analogs in *archimimus*, are higher, sharper and more evident than in *archimimus*, while the other is placed between the two larger ones and is relatively low and rounded; transverse sulci as in *archimimus*: lateral lobes slightly shorter and deeper proportionately than in the other species, ventral margin less strongly arcuate-emarginate cephalad.

Abdomen with the ultimate tergite (supra-anal plate) with the same pattern and sculpture seen in *archimimus* but distal section with its lateral margins more acutely arcuate-convergent to the very slightly rounded acuminate apex, the surface of the same area not concave medio-longitudinally: cerci similar to but proximad more robust than those of *archimimus*. Ovipositor valves in profile similar to but in ventral aspect more slender than those of *archimimus*, ventral surface of ventral valves much less excavate.²⁴ Ultimate sternite (subgenital plate) with its medio-distal production more elongate and aciculate than in *archimimus*.

Prosternal process as in *archimimus* but bordering rim lacking the lateral tuberculations. Interspaces between the mesosternal and metasternal lobes as in *archimimus*.

Cephalic and median limbs similar to but shorter and stouter than in *archimimus*. Caudal limbs as in *archimimus*,²⁵ except that the external margin of the tibiae have from eight to ten spines, the internal with fourteen to fifteen. Hair brushes of all limbs markedly developed.

Coloration.—General tone light ochraceous-buff, paling on head toward grayish-white, the face, frontal costa and fastigium lightly washed with

²³ This transverse carinula may be entirely a feature of immaturity. I have not used it as a diagnostic feature of the species.

²⁴ I feel this is in part at least due to immaturity, and in consequence it has not been stressed as a differential feature. If fully adult material shows a similar surface contour to these valves, a valuable additional specific character is indicated.

²⁵ The apices of the caudal femora more nearly approach the abdominal apex than as described for *archimimus*, but this is probably due to a moderate amount of abdominal retraction in the type of *arcanum*.

ochraceous-tawny, the face, certain portions of the pronotum, the caudal margins of the mesonotum, metanotum, abdominal tergites and limbs in large part finely flecked with mummy brown to blue-black. The pronotal markings consist of a closely placed pair of dots on each of the larger median carinal tubercles, some scattered small surface puncta and a regular series of quite small marginal puncta on the cephalic and caudal margins. Mesonotal, metanotal and abdominal tergal puncta chiefly in regular series along the caudal margins of the same, although a few discal puncta of equal size are indicated. Limbs with puncta much as in *archimimus*, those of external face of caudal femora somewhat larger than elsewhere, external genicular arch finely pencilled in bluish gray, ventral surface of caudal femora pale, internal face with base pale, a large, partly divided area of mummy brown commencing at proximal fourth and reaching to the pregenicular region, internal genicular arch and base of internal genicular lobe almost entirely mummy brown; caudal tibiae of general color externally, internal face apricot orange, paling proximad, spines very narrowly dark-tipped; caudal tarsi colored as tibiae but internal face nearer ochraceous-salmon on the two more proximal articles, in general pale distad. Ventral surface of body with a broad median mummy brown cloud extending from the mesosternum to near the apex of the abdomen, its boundaries indefinite and nebulous. Antennae obscurely and incomplete subannulate with mummy brown. Eyes buckthorn brown mottled with cinnamon-brown, the whole with a cupreous sheen.

Length of body, 25.4 mm.; length of pronotum, 4.1; greatest width of pronotum, 5.9; length of caudal femur, 13.

In addition to the type I have before me an immature female, in at least one instar younger than the type and bearing the same data, and two distinctly more immature individuals taken at the same locality, but on August 8. While the two last-mentioned specimens are of little value comparatively on account of being somewhat crushed and discolored, the other individual, which I am considering a paratype, fully agrees with the type, differing notably from the latter only in the infuscation of the internal face of the caudal femora, aside from that of the distal extremity, being limited to a single rather small blotch briefly proximad of the pale pregenicular area.

Biological notes.—All of the specimens of the species were taken by beating mats of dead vine stems or the foliage of hanging vines in screens of low trees bordering a road through potreros or meadows. Cantarranas is on the floor of the valley of the upper Rio Choluteca, which carries an intrusion of the Pacific costal semi-arid belt many miles inland. The whole aspect of the valley there suggests the conditions seen in much of the Pacific coastal plain of the Republic of El Salvador, although the surrounding mountains are clothed with vast stretches of pine and topped with areas of subtropical cloud forest, each one harboring a very marked and distinct life element.

CRISTOBALINA,²⁶ new genus

Genotype.—*C. sellata*, new species.

This very strange genus, which combines a type of sellate pronotum, rugoso-nodose sculpture, micro-lobiform tegmina and abbreviate metasternal lobes found in no other known member of the Euthymiae, is apparently a remarkably modified derivative of the *Rhcnoderma* phylum of the group. These unusual features are developed upon, and to an extent mask a general head structure, pronotal proportions and limb characters which show the underlying relationship.

Generic features.—Subapterous; form stockily rhcnodermoid; surface rugose, limbs and much of ventral surface heavily pilose. Head short, broad, face subvertical, fastigium declivent, passing into frontal costa without marked differentiation, paired supra-antennal acute tubercles present laterad on fastigium; occiput with a transversely disposed series of three nodose tubercles; frontal costa broadly subquadrate dorsad of antennae, with a transverse carina at point between same, markedly narrowed ventrad of this, whence the margins regularly diverge to the clypeal suture, sulcate ventrad of transverse carina; supplementary facial carinae distinct. Pronotum short, broad, sellate; median carina indicated cephalad and caudad as linear nodes, obsolete mesad in ♀, much less marked in ♂; three transverse sulci indicated laterad, but one (the second) continuously marked across dorsum; cephalic margin shallowly obtuse-angulate emarginate mesad, caudal margin weakly emarginate mesad in ♀, hardly so in ♂; surface of pronotum on each side in ♀ with two longitudinally disposed linear groups of irregular short rugae and clumps of tubercles weakly indicated in ♂. Caudal margin of mesonotum sinuato-truncate; of metanotum bisarcuate. Tegmina minute, lobiform, hardly surpassing mesonotal margin in ♀; in ♂ very minute, hardly evident. Wings absent. No external auditory tympana indicated. Prosternal process low, transverse; mesosternal lobes (♀) broadly separated by a strongly transverse interspace; metasternal lobes very short, widely separated by a moderately (♂) to strongly (♀) transverse but very abbreviate interspace. Ovipositor valves of female short and stout, internal margins of ventral face of ventral pair lamellate; ultimate sternite (subgenital plate) in ♀ subquadrate with mediiodistal process elongate aciculate. Limbs rhcnodermoid, surface often carino-rugulose; cephalic femora not at all compressed, median femora appreciably compressed; caudal femora subcompressed, margins weakly serrulate, ventral ones entire, genicular lobes acute; caudal tibiae subsinuate, flexor surface deplanate, seven to eight external spines, nine to ten internal ones; caudal tarsi with proximal, second and distal articles subequal in length.

Cristobalina sellata,²⁷ new species. Text-fig. 13; plate 2, figs. 7-10; pl. 3, figs. 12-14.

Type.—♀; San Cristobal,²⁸ State of Chiapas, Mexico. June 27, 1926. (Dr. A. Dampf.) [Hebard Collection, Type no. 1324.]

²⁶ From the type locality of the genotypic species—San Cristobal, Chiapas, Mexico.

²⁷ In allusion to the saddle-shaped pronotum.

²⁸ The altitude of San Cristobal is in the neighborhood of 6500 feet (2000 meters).

Size medium; form robust, stocky; surface in general rugulose, in certain areas, as the metazona of the pronotum, the lower portion of the lateral lobes of the same and more sparingly on the pleura, papilloso-tuberculate; pilosity of areas of venter and limbs marked.

Head with its evident length, as seen from dorsum, no more than half its caudal width; eyes quite prominent, particularly laterad, less so dorsad and not rising to the line of the occipital tubercles, in lateral view the eyes are broad ovate in outline, subequal in depth to infra-ocular portion of genae, with their longer axis vertical: occiput low convex, with three transversely disposed, moderately polished spaced nodose tubercles, which are placed slightly cephalad of the caudal margin of the eyes, the median one faintly in advance of the others and more circular as seen from dorsum, lateral ones close to the eye margin and obliquely (divergent cephalad) linear as seen in same view: fastigium rounding ventro-cephalad from the occiput, not clearly delimited, bearing dorsad of each antennal socket a latero-cephalad directed acute ocelligerous tubercle, between which the facio-fastigial juncture is subexcavate, like the fastigial surface with a few scattered micro-tubercles but without any delimiting transverse carina: frontal costa as seen in cephalic aspect with dorsal half subquadrate, subdeplanate, lateral margins of this half weakly diverging dorsad beneath the ocelligerous tubercles,²⁹ interantennal carina of costa marked, straight transverse, lateral margins of costa sharply constricted briefly ventrad of the transverse carina, thence less decidedly diverging to the clypeal suture, which they attain, surface of ventral portion of costa largely shallow excavate: lateral (supplementary) facial carinae marked, nearly straight, faintly diverging ventrad. Antennae damaged (in paratype twice as long as pronotum, moniliform, composed of 22 articles).

Pronotum broader than long when seen from dorsum, slightly widening caudad in same view; surface with many small asperous tubercles secondary to the major sculptural features: cephalic margin of disk shallowly obtuse-angulate emarginate, with obsolete lateral bounding tubercles; caudal margin with its weak median emargination penetrating the tectate median carina: in profile the median carina is seen to be moderately elevated in cephalic third, obsolete in the strongly sellate median third and low cristate in the caudal third, the outline in the latter being arcuate; from the dorsum these areas are seen to be linear nodes, the more caudal on a tectate elevation of the pronotal surface: three transverse sulci seen in lateral aspect, one close to cephalic margin, one submedian and sinuous, the third close to the caudal margin, not more than a fourth to fifth of the pronotal length removed from it, of these the median alone bisects the median line of the pronotum, this at three-fifths its length from cephalic margin: lateral lobes of pronotum subquadrate, slightly narrowing ventrad, ventral margin of same distinctly concavo-sinuate in cephalic half; longitudinal postocular series of rugae and tubercles marked, the most elevated element at caudal margin. Pronotal episterna rounded cephalad, not extending cephalad of adjacent portion of lateral lobes, their cephalic and ventral margins definitely cingulate.

²⁹ In the paratypic female these carina are more definite here than in type. They are sharply incurved mesad then as strongly divergent to the paired tubercles, which they join.

Mesonotum very narrowly visible caudad of the pronotum. Tegmina lobiform spatulate pads not extending distad of the caudal margin of the mesonotum. Metanotum five times as long as exposed portion of mesonotum, distal margin markedly bisarcuate, no wing rudiments present: metapleura with a distinct elevated oblique ridge of nodose tubercles on the episternum, and a weak replica of the same on the epimeron. Prosternal process for its full width truncate bevelled on cephalic face, the transverse low ridge substrumously thickened, its lateral extremities roundly obtuse-angulate, caudal face as seen in profile rounding to the inter-foraminal transverse impression. Mesosternal lobes separated by a rectangulate interspace twice as wide as its greatest length, internal margin of lobes subarcuate, slightly diverging caudad, caudal margin of mesosternal lobes oblique truncate. Metasternal lobes broader than long, roundly narrowing toward middle line of body, in which direction their exact outline cannot sharply be delimited from the impressions leading to the foramina, their caudal margins transversely low arcuate; interspace between metasternal lobes broad, very short, mesad its cephalic border is broadly convex, leaving a definite but shallow transverse arcuate inter-foraminal channel.

Abdomen with tergites moderately and sublinearly longitudinal multi-rugose, a median series extending from proximal to ninth tergite more prominent than the more lateral ones, the distal end of it on each tergite from the fourth to ninth subtuberculate: ultimate tergite sublinguiform, lateral margins converging, apex broadly rounded and weakly emarginate mesad, surface subdepressed proximad and distad, not at all sulcate: ultimate sternite (subgenital plate) as seen from venter subquadrate, faintly longer than broad, distal margin produced meso-caudad into an elongate acute spiniform process, reaching over two-thirds the distance to the apices of the ventral ovipositor valves: cerci styliform, subequal in width in proximal half, acutely tapering in distal half: infra-cereal plates very large, extending slightly distad of ultimate tergite and meeting on median line. Ovipositor valves robust, short, the dorsal in repose apparently extending little distad of infra-cereal plates, dorso-external margin with a distinct pre-apical shoulder, dorsal surface strongly concavo-excavate; ventral valves slightly shorter than dorsal ones, ventral surface strongly concavo-excavate, proximal arcuate (from venter) section of the internal margin markedly lamellato-elevated.

Cephalic femora and tibiae very definitely rhenodermoid, subdeplanate on flexor surfaces, obscurely multistrumose on other surfaces, cephalic ones incompletely bicarinulate. Median limbs more compressed than cephalic, similarly but more numerous and more strongly carinulate; femora enlarging and deepening distad, cephalic genicular lobe quite large. Caudal femora extending slightly distad of apex of abdomen, greatest depth four and a half in length: dorsal carina with low and widely spaced serrulations, near base sinuato-sublamellate as in *Rhcnoderma*; dorsal and ventral margins of external pagina noduloso-serrulate; pagina sharply etched, relatively regular proximad; genicular lobes with apices distinctly acute, ventral margins with a marked but rounded slightly premedian lobe, thence distad concavely emarginate to distal point: caudal tibiae with pilosity very decided, external spines more robust than internal, latter more falcate than external; internal spurs distinctly larger than external ones, in each

the internal one of the pair is slightly longer than the other: caudal tarsi very slender, the whole equal to three-fifths the tibial length.

Allotype.—♂; Chichen Itza, Yucatan, Mexico. July 27, 1937. (J. Van Tyne.) [Museum of Zoölogy, University of Michigan.]

Differing from the above description of the female type in the following noteworthy respects.

Size relatively small; form similar to but proportionately less robust than in female; surface similar to but on nota and abdominal dorsum less strongly rugulose, papilloso-tuberculate condition much less developed; limb and venter pilosity less marked.

Head with its evident length, as seen from dorsum, slightly less than half its caudal width; eyes larger and even more prominent laterad than in female, in lateral view distinctly deeper than infra-ocular portion of genae; occiput with the three nodose tubercles similarly disposed but more circular and less linear than in female: frontal costa as in female. Antennae over two and one-half times as long as pronotum.

Pronotum in dorsal view but faintly widening caudad, transverse rect-angulate in outline; surface as a whole with fewer asperous tubercles secondary to the major sculptural features: caudal margin of pronotal disk entire, not distinctly emarginate as in female: in profile the elevations of the median carina in the female are seen to be represented by much lower and far more rudimentary homologues, the more cephalic of which is seen from the dorsum to be more circular, less linear and placed caudad of the shallow impression of the cephalic (or first) transverse sulcus: transverse sulci as in female.

Mesonotum somewhat more broadly evident caudad of the pronotum than in female. Tegmina very minute, being the merest paddle-like rudiments, not reaching to the caudal margin of the mesonotum and hardly visible to the unaided eye. Metanotum but slightly more than twice as long as exposed portion of mesonotum. Mesosternal lobes with interspace one and one-half times as wide as its greatest length. Metasternal lobes transverse, acutely narrowing toward middle line of body, there virtually in contact.

Abdomen with rugae of tergites less prominent, but with the same relative degree of evidence; penultimate tergite cut away dorso-mesad, the lateral portions reaching to the cercal bases, their dorsal margin near the apparent base having a dentate lobe; ultimate tergite (supranal plate) relatively broad proximad, the lateral margins concavely convergent from near cercal bases to the narrowly rounded apex, surface of ultimate tergite with broader, more proximal portion separated from the acutely narrowing distal section by a shallow obtuse-angulate transverse impression, the proximal area with a slightly indicated subquadrate median portion weakly separated from the lateral areas by subparallel low carinulations: cerci slightly surpassing apex of ultimate tergite, in dorsal view proportioned as in female, in lateral view evenly tapering with apex very slender: ultimate sternite (subgenital plate) cymbiform, moderately compressed, apex in profile subacute, seen from dorsum blunt and weakly bi-impressed, much of ventral surface of tergite with scattered flocculent hairs.

Coloration.—General base color light ochraceous-buff,³⁰ with an over-pattern ranging in tone from tawny and cinnamon-brown to mummy brown and blackish fuscous, the major elements of which are as follows: head washed rather weakly on occiput and fastigium with tawny, infusate caudad of fastigial tubercles (not seen in allotype), the vicinity of the antennal bases and the costa between same with blackish fuscous (less evident in males), many small punctiform points of the same sprinkled over the lower face, genae and occiput, a narrow postocular bar of mummy brown also indicated on head; pronotum with cephalic section of the dorsum washed with prout's brown to mummy brown (much less evident in males), continued caudad as linear maculae on median line and a pair of lateral clouds, lateral lobes ventrad of the principal line of rugae quite solidly washed with cinnamon-brown, paling ventrad (solid in males), all margins regularly notate and discal tubercles marked with mummy brown; remainder of dorsum of body clouded with cinnamon-brown (less evident in males), metanotal pleural and abdominal rugae with symmetrically disposed mummy brown infuscation of certain nodes, in the allotype with a decided fuscous spotting of the numerous abdominal tuberculations. Ventral surface almost entirely prout's brown, the prosternum having a pale base clouded with the darker color. Limbs largely marked with mummy brown on a pale base, the cephalic and median incompletely and irregularly sub-annulate, with in addition a micro-punctulate pattern on the pale areas; caudal femora obsoletely trifasciate (subobsolete in males) with pale mummy brown on dorsal and ventro-lateral surfaces, the pagina partially etched into relief by penciling of the same proximad and very briefly distad, internal and ventral faces solidly blackish fuscous; caudal tibiae and tarsi irregularly flecked with prout's brown, spines narrowly tipped with fuscous. Body and limb pilosity white. Eyes bronzy dresden brown. In the allotype the genae, lower face, normal position of lateral pronotal carinae and certain carinae and tubercles of the head have their usual pale base color washed with pale greenish.

MEASUREMENTS (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum (across lateral lobes)	Length of tegmen	Length of caudal femur
♂, Chichen Itza, Yucatan, <i>allotype</i> ...	14.2	2.5	3.8	—	9.2
♂, Chichen Itza, Yucatan, <i>paratype</i> ...	15.4	2.9	3.7	—	9.6
♀, San Cristobal, Chiapas, <i>type</i>	22.5	4	6.2	.3	13.8
♀, Chichen Itza, Yucatan, <i>paratype</i> ...	20.8	4.2	6	.5	12.8

In addition to the type and allotype of this very remarkable and bizarre genus and species, I have before me an additional male and female taken at

³⁰ The type and allotype have preserved their natural color. The two paratypes at some time have been immersed in a liquid preservation and their natural coloration has very largely been destroyed.

Balam-Canche Cave, Chichen Itza, Yucatan, Mexico, June 24, 1932, by E. P. Creaser, and belonging to the Museum of Zoology of the University of Michigan. These I am considering paratypes. Such minor features of variation as are exhibited by the available small series have been touched upon in the preceding description.

Of the known Neotropical genera of the Euthymiae *Cristobalina* is in some respects the most unusual and distinctive. While lacking the marked fastigial specialization of *Bactrophora*, it has a considerable number of features shared with no other member of the group. The form of the pronotum, the character of the tegminal reduction, the sternal proportions, and the ovipositor type, to mention but a few, are definitely characteristic.

Distribution.—The distribution of the species is of a most unusual type. Few species are found common to the arid scrub forest of little elevated Yucatan, and the virtually temperate conditions to be encountered in the vicinity of San Cristobal, Chiapas, the type locality, where forests of pine, oak and other non-tropical species are to be found. We do not know the immediate habitats in which the specimens now reported were taken, but it is evident we have similar ecological niches at the two localities, or *Cristobalina* is a rather widely ranging and adaptable type. From what I know of its relatives I feel strongly the latter possibility is hardly the true explanation. The probability is that at Chichen Itza, near sea-level, and at San Cristobal, at approximately 6500 feet elevation, we shall find a sufficient similarity of immediate environment, on the restricted scale which is sufficient for insect life survival, to explain the presence of *Cristobalina* at these quite dissimilar localities.

MEZENTIA Stål

1878. *Mezentia* Stål, Bihang K. Svenska Vet.-Akad. Handl., V. no. 4, pp. 43, 88.

Genotype (by monotypy).—*M. gibbera* Stål.

This striking genus very greatly suggests a brevialate *Rhcnoderma*, but the most casual examination will show marked differences in fastigial and pronotal structure, aside from the alate condition. When compared with *Rhcnoderma* the fastigium is seen to be cut off from the frontal costa by a definite transverse carination, while the latter has no transverse inter-antennal carina, the pronotum is deeply and conspicuously, instead of finely, incised by the three transverse sulci, with the metazona occupying at least two-fifths, instead of less than a third, of the total pronotal length, in addition to which the short but fully functional tegmina and wings are quite distinctive.

While we know *Mezentia* from but a few specimens, these are ample to show it possesses at least four species, three previously unrecognized, and also to demonstrate that the assemblage is distributed over a consider-

able portion of Tropical America. It is quite possible that the species are quite local and areally limited, and that a number remain to be discovered.

Generic features.—Brevialate; general form otherwise strongly rhinodermoid; surface in places pilose. Head short, broad, face subvertical with fastigio-facial angle subproduced; fastigium transverse, declivent subconcave, separated from frontal costa by a transverse carina on fastigio-facial angle; frontal costa broad dorsad, sharply constricted ventrad of median ocellus, lacking a transverse carina dorsad of same, subobsolete before reaching clypeal suture; antennae with 23-24 articles. Pronotum selliform, transverse sulci deeply cut, surface cribrosely impresso-punctate; cephalic margin of disk concave mesad, this bounded laterad by subangulations; caudal margin very obtusely angulate; no median carina, metazona at least three-fifths as long as prozona; lateral lobes of pronotum subquadrate; pronotal episterna produced. Tegmina reaching to middle of abdomen, subcoriaceous; aside from humeral trunk the major venational features range from little to appreciably evident, in the former condition is found an open net-like venation with interstitial areolets. Wings developed equally with tegmina. Prosternum with marked, rounded erect tubercle; mesosternal lobes with interspace longitudinal to quadrate in ♂, quadrate in ♀, metasternal lobes attingent (♂) or narrowly separated (♀). Proximal abdominal tergite with distinct tympana placed ventro-laterad. Cephalic and median limbs short, stout; cephalic femora subinflated, deplanate ventrad, median femora subcompressed, subarcuate in profile; cephalic tibiae subdeplanate, median ones subcompressed. Caudal femora compressed, finely serrulate on dorsal margin, the ventro-lateral one weakly serrulate to entire, genicular lobes subrectangulate to subacute; caudal tibiae with five³¹ to six external and six internal spines, one of which is apical in each case; caudal tarsi very slender and elongate, equal to at least three-fifths the length of the tibiae, proximal and second articles nearly or quite subequal in length.

Distribution.—Tropical lowland rain-forest areas of Central America and Amazonia. Known from the northern coast of Honduras, Panama (specifically eastern) and the Upper Amazon in eastern Peru and western Amazonas, Brazil.

Key to Species

1. Pronotum having caudal part of prozona and metazona subinflated and elevated dorsad of remainder of disk; scattered asperous tubercles present on dorsum of metazona and dorsad on lateral lobes. Ventro-lateral margin of caudal femora weakly serrulate. Interspace between mesosternal lobes quadrate in ♂ (♀ unknown). Tegmina with principal longitudinal venation well differentiated. (Panama.)

gibbera Stål

Pronotum having metazona little or not at all elevated dorsad of remainder of disk; no true asperous tubercles present on dorsum of metazona or on lateral lobes. Ventro-lateral margin of caudal femora

³¹ The single specimen of *M. gibbera* has but four spines on the single remaining caudal tibia, but the spacing shows one failed to develop properly.

entire. Interspace between mesosternal lobes longitudinal in ♂ (*M. cutteri* known only from ♀). Tegmina with principal longitudinal venation little differentiated. 2

2. Fastigium moderately declivent. Pronotum without dark postocular bars dorsad on lateral lobes. Prosternal spine relatively broad and thick, subtransverse. Caudal femora either conspicuously banded with rufous or multipunctate on external surface with blue-black 3
- Fastigium sharply declivent. Pronotum with definite but not sharply delimited dark postocular bars dorsad on lateral lobes. Prosternal spine more slender, less thickened, and not at all subtransverse. Caudal femora neither conspicuously banded or multipunctate externally. (Size small, ♂ only known.) (Amazonian Brazil.)

acanthopyga, new species

3. Size large (♀ only known), length of body, 46.5 mm. Pronotum distinctly strumose-tumid between the transverse sulci, latter not pencilled with blackish. Caudal femora broader, multipunctate on external surface or on dorsal margin with blue-black, ventrad solidly blue-black. (Honduras.)*cutteri*, new species

Size small (♂ only known), length of body 23.3 mm. Pronotum hardly at all strumose-tumid between transverse sulci, latter in greater part pencilled with blackish. Caudal femora narrower, on external surface trifasciate with rufescent, ventrad solidly rufescent. (Eastern Peru.)

visenda, new species

***Mezentia gibbera* Stål.** Text figs. 1-5.

1878. *[Mezentia] gibbera* Stål, Bihang K. Svenska Vet.-Akad. Handl., V, no. 4, p. 588. [♂; Panama.]

Of this species, the genotype of *Mezentia*, I have seen only the single distorted and decolored male individual from Porta Bello, Panama, already recorded by Hebard.³² This specimen, which was taken from the stomach of a bird (shot March 25, 1911), was described at considerable length at the time it was recorded, and I have little to add to the comments already published by Hebard, other than to present four illustrations which may aid in the recognition of the species, and to give a few features which appear worthy of note.

The color of the Porto Bello specimen has been completely destroyed and nothing can be added from it to Stål's description of the coloration drawn from the type.

The emphasis placed by Hebard on the bidentate (or more properly binodose) character of the fastigium is due almost entirely to shrivelling of the chitin exaggerating a tendency which is also exhibited to a slight degree in *M. visenda*.

The complex male genitalia of this species are best understood by reference to the figures of the same here presented (Text-figs. 3 and 4). The sole available and apparently only second known specimen, however, is

³² Trans. Amer. Entom. Soc., L, p. 112, (1924).

so twisted and distorted that a certain amount of reconstruction has been necessary to present understandable illustrations of these highly specialized parts.

The closest relationship of *M. gibbera* is clearly with *cutteri* and *visenda* here described. The former of these two species is known only from the female, the latter from the unique male. The species *visenda*, however, is very much smaller than *gibbera*, has a simpler, less inflated type of pronotum, more generalized tegminal venation and numerous differing details of the genitalic features, one of which is the bifid cerci. When *gibbera* and *cutteri* are compared, and allowance is made for sexual differences, the latter is seen to have the eye more vertical, the pronotal surface, while cribrately impressed, is without the definite tubercles seen in *gibbera*, and not decidedly inflated caudad on the disk as in *gibbera*, the tegminal venation is more anastomosing and with a much less definite emphasis of the longitudinal veins, the median and caudal femora are strongly compressed, the dorsal margin of the latter is more strongly serrulate, while the ventral margin of the same is definitely serrulate. In addition the apices of the genicular lobes of the caudal femora are less distinctly acute in *gibbera* than in *cutteri*, and the prosternal tubercle is narrower and less expanded than in the Honduranian species. There is virtually no possibility *gibbera* and *cutteri* represent sexes of the same species, although they are clearly closely related forms. Of the measurements of the present specimen already given by Hebard, certain are here repeated for comparison: length of body (computed on account of curvature in drying), 32 mm.; length of pronotum, 6.8; greatest width of pronotum, 6.8; length of tegmen, 13.3; length of caudal femur, 20.7.

Probably the species is limited to rain-forest conditions in eastern Panama, such as the vicinity of Porto Bello affords. The original record was merely "Panama".

Mezentia cutteri,³³ new species. Text-figs. 6-9; plate 6, fig. 31; pl. 7, figs. 37-39.

As the present species is the only one of the genus of which the female sex, and that alone, is known, it is hardly possible to make detailed comparisons of it with *M. gibbera* and the two Amazonian species here described. The present one, however, is far larger than either of the latter, and of slightly greater bulk than *M. gibbera*. The above key should, however, prove sufficient to distinguish the forms here discussed. The tegmina of *cutteri* also are shaped quite differently from those of *acanthopyga*, but unfortunately the apices of the tegmina of *visenda* are damaged and a full comparison thus cannot be made. Aside from the other features given in

³³ In recognition of the coöperation and interest of Mr. Victor M. Cutter, formerly President of the United Fruit Company, in increasing our knowledge of the animal and plant life of the American tropics.

the key and discussed elsewhere the color pattern of *cutteri* is very different from that of either *visenda* or *acanthopyga*. The single available specimen of *gibbera* has been completely decolorized.

Type.—♀; Lancetilla, near Tela, Department of Atlantida, Honduras. Elevation, 300 feet. September 8, 1930. (Honduras Expedition, J. A. G. Rehn; swept from ground cover in heavy rain-forest.) [Academy of Natural Sciences of Philadelphia, Type no. 5525.]

Size large (for group); from moderately robust; surface of lower face and genae finely impresso-punctate, of pronotum and pleura strumously impresso-punctate, particularly marked on pronotum, remainder of surface largely subglabrous.

Head with greatest width across genae equal to nearly twice the length of head as seen from dorsum; occiput rather low convex, passing without marked distinction into the moderately declivent fastigium which over all is twice as broad as long and with its surface shallowly subexcavate, cephalad the fastigium is transversely truncate at the fastigio-facial angle, ocelli borne on the low, not at all elevated rounded lateral nodose borders of the fastigium; fastigio-facial angle in profile distinct but rounded obtuse-angulate, definitely projecting cephalad of the ventral portion of the face; frontal costa with the dorsal half subquadrate in outline, its greatest width briefly ventrad of fastigio-facial angle, slightly narrowing thence to the median sulcus, immediately ventrad of which the margins are sharply constricted, then as sharply expand again to the same degree they did dorsad of that point and subparallelly continue with less definite indication to the clypeal suture, surface of frontal costa shallowly rugulose and subimpressed in its broader dorsal portion, with no trace of a transverse inter-antennal carina, and subsulcate in the constricted and the broader ventral sections; lateral (supplementary) facial carinae distinct but becoming subobsolete ventrad. Eyes moderately prominent, separated at occiput by an interval subequal to the greatest cephalo-caudad eye dimension as seen from dorsum, in later aspect elliptical in outline, the axis of their greatest dimension slightly inclined from the vertical. Antennae faintly shorter than the combined length of head and pronotum, slender, very faintly depressed, composed of twenty-five articles.

Pronotum in general form moderately but quite definitely sellate, the surface, except in the immediate vicinity of the cephalic margin of the disk and lateral lobes, with a densely anastomosing and interlacing pattern of substrumose rugulae, between which are impressed areolets of varying size; greatest width of caudal margin of disk but slightly less than the median length, metazona equal to three-fifths of latter; cephalic margin of disk with median emargination very shallow and broad, subangulate, lateral bounding points equally low and of a similar slight degree of angulation; caudal margin of disk very slightly obtuse-angulate with the median point very broadly rounded; no median carina indicated but in its usual position a low elevation is present between the first and second sulci; four transverse sulci strongly impressed, the first (cephalic) less definite mesad than the others, which are continuously marked across the disk: lateral lobes subquadrate; caudal margin weakly oblique subsinuate, ventral margin

with ventro-cephalic angle rectangulate, the ventro-caudal rounded sub-obtuse-angulate. Pronotal episternum moderately produced cephalad of cephalic margin of lateral lobes, subspatulate, rounded, its ventral margin concave.

Tegmina reaching to faintly distad of middle of fourth abdominal tergite, in expanded shape ovoid with the apex transversely arcuato-truncate, the greatest width, which is faintly proximad of middle, contained slightly more than twice in the length, texture subcoriaceous, the anastomosing venation raised or etched into marked relief; costal margin arcuate, more sharply so proximad, sutural margin arcuate with distal third nearly straight oblique to apex; marginal field at widest point of tegmina equal to two-fifths of total breadth of tegmen, anal field at same point of same breadth, discoidal field, which evenly widens distad, even at apex not surpassing the breadth of the other fields at the broadest point of tegmen; humeral trunk with its component veins well indicated, median vein distinguishable, anal vein apparent, other elements not clearly indicated in the general lacework of raised venation. Wings fully developed, in repose reaching as far distad as tegmina, broad auriculiform, venation of anterior field weak and subsinuous, radiate veins not at all robust, but straight and normal.

Prosternal process well developed but low and moderately transverse, rounded. Mesosternal lobes with interspace moderately transverse, internal margins of lobes definitely convex, caudal margin of lobes suboblique sinuato-truncate. Metasternal lobes narrowly separated, the interspace being a narrow cross-shaped area, about three times as long as least (median) width, from which point distad the disto-lateral margins of the lobes are rather broadly arcuate.

Ultimate abdominal tergite (supra-anal plate) elongate, far surpassing the cercal apices, in outline subpyramidal, its converging lateral margins definitely sigmoid in their proximal three-fifths, thence very acutely converging to the hastate apex, the sigmoid portions of the lateral margins finely but definitely cingulate, with a similar transverse concave carina crossing the tergite at its proximal third, definitely dividing the surface into two areas, medio-longitudinal section of the tergite with a poorly marked longitudinal sulcation, shallow and indefinite except in distal third, a punctiform pit indicated at the middle of the tergite: cerci styloform, stout, regularly tapering to the acute apex, which falls short of the distal extremity of the infra-cercal plates, which in turn do not surpass the distal third of the ultimate tergite: ultimate sternite (subgenital plate) quadrately scaphiform in ventral view, the lateral portions of the sternite subvertical, particularly distad; ventral surface of sternite with rounded lateral cariniform borders outlining an ovate area, not defined proximad, the same borders stopping abruptly in an angular shoulder a very short distance before reaching the subtruncate, very shallowly obtuse-angulate distal margin of the sternite, which latter is also finely erosulate, developing further an elongate erosulate median spine, which extends distad between the ventral valves of the ovipositor a distance subequal to a third the distal width of the sternite; ventral surface of ultimate sternite bearing within its ovate bounding margins a sagittate deplanate plate, constituting the surface of the proximal half of the sternite and masking much of the more

distal section of the same, the distal margins of this plate sinuately convergent to the acute subspiniiform apex, which lays against, and could be confused with, the base of the median spiniiform process of the distal margin of the sternite, laterad of and beneath the marginal base of this plate are pore-like openings.³⁴ Dorsal valves of ovipositor slightly surpassing ventral valves in length, in profile with their dorsal outline gently arcuate, entire, sublamellate distad, seen from dorsum the narrowly rounded apices are distinctly in-bowed, dorsal surface of dorsal valves deplanate and impresso-punctate proximad, becoming distinctly concave-excavate distad, the internal margin there being distinctly concave and decurved; ventral valves of ovipositor with the lateral basal plate-like section subvertical, deep, its dorsal margin oblique subsinuate, terminating in an acute point which is slightly outcurved laterad when seen from venter, ventral margin of the basal section nearly straight when seen in profile, crenulate, moderately concave when seen from venter; ventral surface of proximal two-thirds of ventral valves lamellate, about three times as long as broad, distal margin of the two combined arcuate, surface markedly cribroso-punctate; ventral valves proper short and stout in profile moderately falcate, ventral surface deplanate distad to a pronounced external tooth, thence sculptured much as the dorsal surface of the distal section of the dorsal valves.

Cephalic and median limbs short, rhinodermoid; cephalic femora distinctly deplanate and glabrous ventrad, with a distinct brush of hairs on caudal margin which extends to the coxae, dorsal surface arcuate transversely with a longitudinal carina on cephalic side, cephalic genicular lobe rounded acute; cephalic tibiae depressed, deplanate and glabrous ventrad, with caudal marginal brush as on the femora: median femora definitely compressed, proximal depth about two-thirds that at distal fourth, dorsal margin moderately arcuate, ventral surface subdeplanate, cephalic genicular lobes rounded subacute, ventro-cephalic margin with a pronounced brush of long hairs, a sparser one fringes the dorsal margin; median tibiae moderately compressed, both external and internal faces deplanate, marginal brushes continuous with those of femora. Caudal femora with greatest depth contained slightly more than four times in length; dorsal margin with widely spaced and weak serrulations, the usual proximal rhinodermoid twist of this margin definite but not at all pronounced, ventral carina and paginal carinae entire, paginal pattern regular; genicular lobes moderately arcuate, ventral margin of lobe arcuate, not at all sinuate: caudal tibiae but slightly shorter than the femora, with the tarsi thickly pilose, deplanation of flexor surface marked, extensor surface declivent with external margin elevated and internal not at all cingulate, external spines five, internal six in number, one apical in each case: caudal tarsi very slender, three-fifths as long as tibiae, the articles subequal in length, arolium of moderate size.

Coloration.—Base color of head, pronotum, tegmina, pleura, sterna and cephalic and median limbs honey yellow, passing to cinnamon on the abdomen and becoming deep olive-buff (of Ridgway) on the caudal limbs. Head, pronotum, pleura and median limbs, and sparsely on the cephalic limbs, speckled with a punctate pattern of blue-black, the puncta very

³⁴ These are apparently glandular from the quantity of hardened excreted material which resists attempts to dissolve or remove it with alcohol.

dense but individually small on the lower face and genae, larger and sparser elsewhere, on the pronotum forming a definite marginal beading, more spaced and individually larger on the caudal margin, the surface puncta well scattered over the pronotum. Tegmina with the close net-like venation of the pale base color, the interstices pale leaf green. Wings entirely washed with buffy citrine. Venter uniform in color. Caudal femora with a spaced marginal beading of blue-black as well as an open punctation of the same scattered over the paginal pattern, ventral and internal faces solidly blue-black, genicular arches tawny, outlined dorsad with blue-black; caudal tibiae with external face clouded with dusky drab, internal face and internal half of ventral face solidly blue-black, spines black; caudal tarsi paler on external than internal face, distal article transversely infusate at apex, tarsal claws all solidly infusate distad. Antennae with two proximal articles pale, remainder solidly blue-black.

Length of body, 46.5 mm.; length of pronotum, 8.8; greatest width of pronotum, 8.5; length of tegmen, 17.4; greatest width of tegmen, 7.9; length of caudal femur, 20.8.

Unfortunately the type of this very striking and easily recognized species is unique. From the differences which we know exist in the structure of the male genitalia of the other species of the genus, of which the female sexes are unknown, it is hardly possible to even suggest what the unknown male of *cutteri* may possess in genital features.

Biological notes.—On September 8, 1930, while pushing up a narrow forest trail in the foothills of the Sierra Pija, which surround Lancetilla, toward a small clearing which had already netted me the then undescribed *Eumastax hondurensis*, I methodically swept the undergrowth bordering the narrow path. A very definite "thump" in my net gave indication I had achieved some substantial result and the type specimen of *Mezentia cutteri* proved to be the cause. Whether it normally inhabits the lower growth or is partial to the numerous lianes, and my beat had dislodged it from a higher level, I do not know. It is, at all events, an inhabitant of the heaviest type of lowland rain-forest, made up of wild figs (*Ficus* species) ceibas and corozo palms (*Attalea gomphococca*).

An early departure for the United States permitted me to make but one subsequent search for this species in its preferred habitat, but without success. A number of visits had been made to the same forest area, however, in the two weeks preceding the capture of the type. Apparently the species is rare or has at least the usual secretiveness of the members of this group.

Mezentia visenda,³⁵ new species. Plate 5, fig. 30; pl. 6, figs. 32 and 33; pl. 7, figs. 40, 41 and 43.

The principal features separating this species from the other members of the genus have been given in the key to the forms. Its relationship is

³⁵ *I.e.* worthy to be seen.

somewhat nearer to *gibbera* and *cutteri* than it is to *acanthopyga*, but the size difference is so very great and the color patterns so fundamentally different there is no possibility of confusion of the two. As said above under *cutteri* they are most definitely distinct and not sexes of one species.

Type.— δ ; Yurimaguas, Huallaga River, Department of Loreto, Peru. April 15, 1920. (H. S. Parish.) [Hebard Collection, Type no. 1325.]

Size small; form more slender than in *M. cutteri*; surface essentially as in *cutteri*.

Head less strongly transverse than in *M. cutteri*, the exposed dorsal length being equal to two-thirds of width across genae; occiput moderately convex-ascendant cephalad to briefly caudad of the inter-ocular space, where on each side there is a very low, but distinct, rounded juxta-ocular node, whence cephalad the occipital surface descends evenly to the moderately declivent fastigium, the greatest width of which is one and one-half times its median length cephalad of the interocular space, the latter subequal to three-fourths the cephalo-caudal dimension of the eye; fastigium of same form as in *M. cutteri* with disto-lateral angles slightly more emphasized, shallow surface concavity less definitely cut off from occiput and declivity somewhat greater: fastigio-facial angle somewhat more advanced and prominent than in *M. cutteri*, rounded rectangulate in profile; frontal costa less clearly outlined than in *cutteri* although of the same general shape, the lateral borders definite only in dorsal third, infra-ocular constriction indicated, but ventrad of this the bordering carinulae are virtually lost in the rugulose sculpture of the lower face, surface of dorsal third of face distinctly concave, dotted with cribrose punctations; lateral (supplementary) facial carinae distinct and continuous. Eyes moderately prominent, elliptical in outline as seen in lateral aspect, the axis of their greatest dimension more definitely inclined from the vertical than in *M. cutteri*. Antennae incomplete in type.

Pronotum in general form and surface features as in *cutteri* but narrower and subcompressed, the greatest inter-humeral width at the caudal margin subequal to but three-fourths median length of pronotum: cephalic margin of pronotum as in *cutteri* but lateral points bounding the median emargination more thickened and nodose; caudal margin of disk as a whole sinuately obtuse-angulate, the median section arcuately produced on each side of which the margin is subtransversely truncate, thus producing the sinuate general appearance; no median carina indicated; transverse sulci as in *cutteri* but somewhat less sharply incised and the caudal one of the four is less strongly sinuate: lateral lobes of pronotum with ventral margin less concave-emarginate cephalad than in *cutteri*, this section nearly straight and little differentiated from more caudal portion of margin. Pronotal episternum produced cephalad of cephalic margin of lateral lobes, subspatulate, its cephalic angle rectangulate with an accompanying marginal notch dorsad, its ventral margin straight for two-fifths the length caudad of the apex, thence concave.

Tegmina damaged in unique type but in perfect condition clearly surpassing the fourth abdominal tergite, as incomplete they reach distad of the middle of the same; distal extremity and costal and sutural margins

too imperfect to describe their character or give the relative breadth of the marginal and anal fields; venation of undamaged areas similar to that of *M. cutteri* but coarser, often open and with fewer components. Wings developed as fully as tegmina, details of structure not determinable in their damaged condition.

Prosternal process exactly as in *M. cutteri*. Mesosternal lobes with interspace sublongitudinal, acutely expanded briefly latero-cephalad, the least width of interspace at one-third of length, the internal margins of mesosternal lobes decidedly diverging, weakly arcuate, to the shorter, oblique subtruncate caudal margins of the lobes. Metasternal lobes contiguous for almost their entire length, their caudal margins individually convex.

Abdomen with tergites of proximal three-fourths appreciably tectate-carinate medio-longitudinally: penultimate and antepenultimate tergites weakly bullate and subclavate, particularly when seen from dorsum, penultimate tergite with distal margin as a whole broadly concave, bearing mesad a subvertical, ventrad directed, short acute digitiform process, laterad of which the ventral portions of the distal margin are briefly lamellate developed, these subvertical in disposition, each of these three projections apparently fitting into subjacent depressions in the ultimate tergite, disto-lateral angles of penultimate tergite acute, incurved against the cereal bases: ultimate tergite (supra-anal plate) scutellate, divided into two unequal parts, the proximal far the larger, truncate subcuneiform its greatest proximal width subequal to the median length, lateral margins evenly converging distad for two-thirds their length, the distal third of these subspatulately arcuate, the distal border of this basal section inset and transversely truncate; surface of basal section with swollen and rounded marginal ribs, which distad, where the margin is subspatulate, give place to appreciable, slightly striate, paired concavities, median surface of basal portion of tergite with a medio-longitudinal sulcation, which is deeply excavate proximad, and a pair of lateral sulciform impressions terminating at the subspatulate sections of the lateral margins, all three appreciably interrupted mesad by another rectangular transverse impression; distal section of ultimate tergite small, acute linguiform, less than half as long as basal section, inset in transverse truncation of distal margin of latter, in transverse section V-shaped: cerci reaching caudad as far as apex of ultimate tergite, deeply bifid, dorsal fork inflated, in profile moderately decurved distad, dorsal surface of fork deplanate proximad, acute distad; internal face with a distinct tooth, directed internally, at middle of length; ventral fork nearly as long as dorsal, transversely sublamellate, dorsal surface concave, apex moderately acute as seen in ventral aspect, whole appearance of ventral fork of cerci suggesting that of an infra-cereal plate: ultimate sternite (subgenital plate) subcompressed, apex acute in both lateral and ventral views, dorso-lateral margin shallowly concave; pallium moderately elevated dorsad of sternite borders.

Cephalic and median limbs similar to but even stockier than in *M. cutteri*, surface more rugose, the cephalic femora without a definite dorso-longitudinal carina, the thickening of the caudal margin of the flexor surface more definitely strumose and the brush of hairs on the same less continuous and less dense; median femora heavier and uniformly deeper,

less expanding distad, the dorsal margin rather strongly and uniformly arcuate, cephalic genicular lobe less subacute and more nearly rounded rectangulate than in *M. cutteri*, dorsal margin virtually without hairs, ventral margin with the brush less dense than in *M. cutteri*; median tibiae with deplanation as in *cutteri*. Caudal femora with their apices slightly surpassing the abdomen, relatively slender, greatest depth contained nearly five times in length, details as described in *M. cutteri* except that the ventral margin of the genicular lobes is sigmoidally sinuate, having an extensive preapical concavity: caudal tibiae with pilosity by no means as dense as that in *M. cutteri*, consisting of but a few scattered long hairs and a very sparse shorter vesture, extensor surface less strongly oblique deplanate than in *M. cutteri*, each margin with six spines, one apical in each case; caudal tarsi damaged.

Coloration.—Pale base color of head, pronotum and abdomen ochraceous-orange, somewhat paler on the last mentioned, the pleura nearer cinnamon-rufous, washed with olivaceous-green dorsad, the venter dull honey yellow. Clypeal suture of head and a narrow, sinuate transverse bar extending across the face between the eyes at the lower edge of the antennal scrobes blackish fuscous, dorsal section of frontal costa washed with russet; eyes bronzy brown; antennae with the two proximal articles of the general color of the head, thence olivaceous-green becoming increasingly infusate distad, each article (as far as antennae are preserved) very narrowly annulate distad with whitish. Pronotum with nearly all of its margins and the three more caudal transverse sulci bordered or pencilled with olivaceous-fuscous, the exceptions being the median areas of the cephalic and caudal margins of the disk, most of the ventral margin of the lateral lobes and most of the lateral portions of the fourth (last) transverse sulcus. Tegmina with the base color olive (of Ridgway), the venation outlined against this dull cream-buff. Abdomen with all of the tergites except the three distal ones narrowly annulate, or more definitely beaded, with fuscous; distal margin of penultimate tergite, with its various protuberances, blackish fuscous, the internal margin and ventro-internal face of the dorsal fork of the cercus and several maculae along the external border of the ventral fork blackish fuscous. Cephalic limbs pale ochraceous-orange passing to cinnamon-brown on tibiae and tarsi; median limbs similar but darker in tone with an obscure clouding of dull olive patches; caudal femora with a base color of light ochraceous-buff, conspicuously transverse trifasciate with liver brown, the genicular extremity with a base of ochraceous-tawny, the genicular arches and distal border of dorsal surface pencilled in olivaceous-fuscous; internal and ventral faces of caudal femora solidly ox-blood red with a pregenicular annulus of ochraceous-buff; caudal tibiae on external face buckthorn brown, obscurely speckled proximad with blackish fuscous, internal face and most of extensor surface shining black with a narrow pretenicular annulus of ochraceous-buff, internal spines, wholly, external spines on internal face and at tips similarly shining black.

Length of body, 23.3 mm.; length of pronotum, 5; greatest width of pronotum, 4.5; incomplete length of tegmen, 8; length of caudal femur, 13.6.

The type of this very striking and distinctive species is unique. There is little doubt but that it is a forest foliage type, probably a vine or tangle dweller from what we know of other members of the group.

Mezentia acanthopyga,³⁶ new species. Plate 6, figs. 34-36; pl. 7, fig. 42.

This species, which is more distinct from the other forms of the genus than they are from one another, can be distinguished very readily by the characters given in the key to the species. As we know the present species and *visenda* solely from the male sex, and *cutteri* on the basis of the female alone, the genitalia can be contrasted only with those of *visenda*, but here we find numerous features of difference, the most apparent being the sharply angulate lateral portions and more numerous appendages of the distal margin of the penultimate tergite of the abdomen and the flexuose but non-bifid cerci.

Type.—♂; Teffe, State of Amazonas, Brazil. December 8, 1929. (H. S. Parish.) [Hebard Collection, Type no. 1326.]

Size slightly larger than in *M. visenda*, very distinctly smaller than in *M. cutteri*; general form and proportions much resembling those of *M. visenda*.

Head much as in *M. visenda* but occiput more definitely and evenly bullate, descending in a regular arcuation to the decidedly more declivent fastigium, but the faintest possible trace present of the juxta-ocular occipital nodes seen in *M. visenda*: fastigium in profile with the angle of declivity greater than 45° , as seen in dorsal view with its general outline suggesting the conventional keystone, the dorsal portion of which is cephalad; juxta-ocular angles of the fastigium, when seen in the same view, appreciably acute; surface of fastigium shallowly but appreciably concave, a small but distinct pit-like impression near the cephalic margin; fastigio-facial angle, in profile, obtuse-angulate, as much as but less sharply produced than in *M. visenda*: frontal costa distinctly separated from the fastigium by the transverse carina of the fastigio-facial angle, dorsal section, i.e. that dorsad of the median ocellus, subscutellate, roughly hexagonal, greatest width, which is on a line with the dorsal margin of the antennal scrobes, subequal to the depth of the same portion, the lateral margins rather sharply constricted immediately ventrad of the ocellus and on a line with the paired infra-antennal transverse sulci, thence these margins diverge and become lost in the general rugosity of the lower face, not clearly reaching the clypeal suture; surface of frontal costa dorsad subexcavate, heavily and coarsely cribroso-punctate, briefly sulcate immediately ventrad of the median ocellus: supplementary facial carinae much as in *visenda*. Eyes in general form and prominence as in *M. visenda* but vertical axis more inclined ventro-caudad. Antennae as in *visenda*, articles twenty-three in number.

Pronotum very similar to that of *M. visenda* but slightly broader across the caudal margin of disk, this width being equal to approximately four-

³⁶ From *ἀκανθα* thorn, and *ὠπὴ* buttocks, in allusion to the angulate lateral processes of the penultimate tergite of the abdomen.

fifths of the median length of the pronotum: cephalic margin with median emargination broader and shallower than in *M. visenda*, with the bounding lateral points less evident and not as nodose; caudal margin of disk very slightly and broadly obtuse-angulate, not at all sinuate laterad of the angle of the margin; no median carina indicated; transverse sulci on disk as in *visenda*; surface of disk of metazona, which is faintly longer than one-third of the median length of the whole pronotum, slightly more deplanate than in *visenda*, with its punctations more regular and more sharply incised: lateral lobes with caudal margin in part at least straighter and more vertical than in *visenda*, interspace between third and fourth transverse sulci slightly wider than in *visenda*. Pronotal episternum as in *visenda* but with cephalic border less advanced cephalad in relation to cephalic margin of lateral lobes of pronotum.

Tegmina lanceolate, acuminate, covering the proximal two-thirds of the abdomen, greatest width at proximal two-fifths, thence narrowing regularly to apex, sutural margins overlapping for two-thirds of the tegminal length; costal margin weakly arcuate in proximal third, thence straight suboblique to the very narrowly rounded apex, sutural margin moderately and evenly arcuate for the whole length of the relatively large anal field; marginal field quite broad, at greatest width nearly equal to two-fifths that of whole tegmen, discoidal field relatively narrow, anal field broad, equal to two-fifths width of whole tegmen; venation of the type found in both *cutteri* and *visenda*, the humeral trunk elements and the anal vein being the only longitudinal veins which are clearly marked, the humeral trunk nearly straight, the anal vein weakly arcuate, somewhat paralleling the curvature of the sutural margin, areolation of the anal field close and less open, and the texture of the field more coriaceous than elsewhere. Wings developed to the same degree as the tegmina, their apices reaching to the tips of the closed tegmina.³⁷

Prosternal process similar to but proportionately more slender and more delicate than in *M. cutteri* and *visenda*, faintly more elevated than in *visenda*. Mesosternal lobes with interspace narrower and more distinctly longitudinal than in *visenda*, shape of the lobes similar. Metasternal lobes similar in character to those of *visenda* but caudal margins less convex and slightly more oblique.

Abdomen with all tergites, in part at least, medio-longitudinally carinate: antepenultimate one very short, laterad no longer than half the length of the preceding tergite, its distal margin broadly but shallowly biconcave with an evenly produced median obtusely angulate production joining the lateral concavities, ventro-laterad the margin is broadly and roundly obtuse-angulate produced before fusing with the penultimate tergite: in contrast to *M. visenda* the penultimate tergite is subconstricted proximad, as seen from dorsum regularly widening to marked disto-lateral acute productions, which in lateral view are seen to be subrectangulate projections of the ventro-lateral portions of the distal margin, dorsad of which angulations the lateral sections of this margin ascend nearly straight to be paired lateral, roundly decurved subdentiform processes,

³⁷ On account of the unique character of the type, and the fact that it possesses many diagnostic features evident without relaxation, I am unwilling to subject it to the hazard of a second relaxation to spread the wings.

which are rectangulate in outline when seen from the dorsum, and separated by a roughly concave median interspace of the distal margin in width equal to one-third the mean width of the whole tergite, this portion of the margin bearing three ventrad-directed dentiform projections, the median one the longer, the bases of all of which are continuous with the median carina of the tergite's dorsal surface (median one), or with obtuse-angulately diverging sub-cariniform folds which become obsolete proximad of the larger paired lateral teeth, the surface of the tergite between the median carina and these flanking folds longitudinally sulcate from its base: ultimate tergite (supra-anal plate) in general resembling that of *M. visenda*, but differing in nearly all of its details, the small distal section shorter than in *visenda*, acute linguiform and not lanceolate, surface subconcave; general outline of proximal section scutellate, lateral margins with a very definite obtuse-angulation slightly distad of middle, proximad of which they are definitely sinuate expanding to base and distad of which they are converging straight oblique to the narrow but marked concavity of the distal margin, into which is inset the linguiform distal section of the tergite; surface of ultimate tergite with vicinity of lateral margins proximad of the angulation somewhat thickened but hardly elevated, paired, converging concave excavations present intramarginally in the distal three-fifths of the tergite, and immediately proximad of which are present paired sub-dentiform tubercles which terminate low subdivergent ridges extending from the base of the tergite, the tubercles also connected by a fine transverse sinuato-concave sulcation, median portion of distal half of surface moderately elevated, mesad in its length with a marked surface impression: cerci subcompressed as seen from dorsum, in profile sharply deflexed from immediate base for two-fifths of their length, narrowing distad, external surface with a rim-like flange indicated proximad and toward the concave portion of the distal margin of the penultimate tergite, the direction of the cercus trend changes abruptly at the proximal two-fifths to first directly caudad for a very short distance, then dorso-caudad to apex, about two-thirds of the whole section distad of the sharp flexure with its dorsal edge broadly developed into a subcultriiform lamellation of even depth and obliquely bevelled on external face, the distal third of this section of the cercus sharply concave-emarginate, isolating the thick, briefly uncinate apex, which is recurved dorsad: ultimate sternite (subgenital plate) markedly compressed, subrostrate, projecting distad of cercal apices a distance equal to two-thirds the length of the ultimate tergite, apex of ultimate sternite as seen from dorsum acute, viewed in lateral aspect faintly acute-angulate, apex free from and caudad of dorsal margins, lateral surfaces of ultimate sternite definitely deplanate proximad, ventrad surface of sternite, except distad, with a definite medio-longitudinal carina, increasing in emphasis proximad. Lateral series of brushes on most of abdominal sternites strongly marked.

Cephalic and median limbs similar to but slightly less robust than those of *M. visenda*; cephalic femora with trace of a medio-longitudinal carina; median femora proportionately somewhat longer than in *visenda*, more gradually deepening distad, dorsal margin more definitely haired than in *visenda*; median tibiae more elongate and less broadened than in *visenda*. Caudal femora distinctly stouter and less attenuate than in *M.*

visenda, their apices equalling but not surpassing the apex of the abdomen, greatest depth contained approximately four times in length, dorsal margin more strongly arcuate than in *visenda*, ventral margin even straighter than in same; genicular extremity more robust than in *visenda*, the lobes similarly formed; paginal pattern with its elements equally numerous but obtuse-angulate, instead of acute as in *visenda*, serrulation of dorsal margin with its elements somewhat more delicate than in *visenda*: caudal tibiae with pilosity far denser and longer than in *visenda*, extensor surface as strongly oblique deplanate as in *M. cutteri*, external margin with five or six, internal with six spines, one apical in each case; caudal tarsi equal in length to two-thirds that of tibiae, markedly long pilose; articles very slender, elongate, subequal in length.

Coloration.—General color of occiput and abdomen tawny-olive, darkening on face, dorsum and dorsal section of lateral lobes of pronotum and much of pleura to snuff brown, the genae paling to clay color along with much of the ventral section of the lateral lobes and several spots on the pleura, ventral surface pale cinnamon-buff. Dorsal section of frontal costa and much of adjacent fastigium washed with bister; antennae bister proximad, darkening distad to fuscous; eyes bronze brown. Pronotum with a narrow longitudinal clouding of fuscous dividing the two color areas of the lateral lobes, the whole cephalic margin between these lateral markings, most of the ventral margins of the lateral lobes, the entire caudal margin and all of the transverse sulci except the cephalic one lined with the same color. Tegmina with the venation old gold, the interstices proximad dark olive, becoming blackish distad. Penultimate abdominal tergite with all of its marginal productions and the distal margin for some distance laterad of these pencilled with blackish, the tubercular nodes on the ultimate tergite and the apices of the cerci also blackish. Cephalic and median limbs light brownish olive; caudal femora on external and dorsal face brownish olive with the carinae and paginal pattern largely outlined in tawny-olive to cinnamon, internal and ventral faces uniform raw sienna, genicular extremity washed with sudan brown, the arches more sanford's brown pencilled with bay, the medio-dorsal emargination of the genicular extremity narrowly marked with blackish; caudal tibiae externally of the color of the external surface of the femora, internally progressively blackish fuscous distad, spines all black tipped; caudal tarsi pale, lined dorsad with fuscous. All body and limb hairs pilvery white.

Length of body, 27.2 mm.; length of pronotum, 5.2; greatest width of pronotum (across lateral lobes), 5.4; length of tegmen, 12; length of caudal femur, 15.4.

The type of this very remarkable species is unique.

BACTROPHORA Westwood

1845. *Bactrophora* Westwood, Arcana Entom., I, p. 66, plate XVII, fig. 2.
1905. *Scolocephalus* Bruner, Entom. News, XVI, p. 314, pl. XI.
1910. *Scolocephalus* Kirby, Syn. Catal. Orth., III, p. 406.

Genotype (by monotype).—*B. dominans* Westwood.

This most striking and aberrant genus was based on a unique female specimen, probably dried from wet preservation judging from the figure,

from an unknown locality. In 1905 when he erected the genus *Scolocephalus*, Bruner was quite unaware of Westwood's name and consequently no comparison was made with it. In the "Biología", which appeared subsequent to the description of *Scolocephalus*, Bruner³⁸ considered his genus and species (*S. mirabilis*) to be synonymous both generically and specifically with Westwood's *Bactrophora dominans*. However, Kirby in 1910, in his "Catalogue",³⁹ considered not only the species but the genera as well to be distinct. In 1921 Serapio Martínez reported⁴⁰ the Madrid Museum contained a male individual of the genus, which he identified as Westwood's genotypic species *dominans*, presumably from Santa Fé de Bogotá, Colombia, and at the same time stated Dr. Uvarov had informed him the British Museum of Natural History possessed, in addition to the type, a single male specimen from British Guiana. The latter specimen is now before me, thanks to the courtesy and cooperation of my colleague Dr. Uvarov and the authorities of the British Museum of Natural History. Apparently this genus is of the greatest rarity in collections, as although it has been known for nearly one hundred years the literature records but four preserved specimens.

The synonymy of *Scolocephalus* is clearly evident from the material in hand, including the unique specimen on which that name was based, but Bruner's *mirabilis* is quite a distinct species from Westwood's *dominans*.

Generic relationship.—What position should be given the genus has troubled previous workers. Westwood, of course using the obvious, i.e. the possession of a greatly produced fastigium, placed the genus in Serville's entirely unnatural assemblage the Conophori. Subsequent authors for decades failed to mention the genus and Bruner did not include it in his 1893 "Révision". Bruner in describing *Scolocephalus* did not attempt to place his genus and in 1908, in the "Biología", inserted it following *Dicaearchus* and before *Trybliophorus*, a more natural position than that of Kirby in 1910, who associated it and the African euthymiid *Pristocorypha* with *Ischnacrida*, *Rhamphacrida* and *Acanthozia*, in all probability on account of the superficially similar fastigial production.

It was only after numerous examinations and comparisons that I became convinced of the propriety of associating *Bactrophora* with the Euthymiae. The exocephalism found in the African genus *Pristocorypha*, which is also a member of the group illustrates the same character of fastigial specialization seen in *Bactrophora*, and the fundamental affinity of that genus with other African genera of the Euthymiae lacking produced fastigia, is clearly evident.

³⁸ Biol. Cent.-Amer., Orth., II, p. 250, (1908).

³⁹ Syn. Cat. Orth., III, p. 406.

⁴⁰ Tomo Cincuentenario, Mem. R. Soc. Españ. Hist. Nat., p. 505.

Dismissing possession of the remarkable fastigial process and also realizing that *Bactrophora* is more cylindrical in general form than the other American genera of the Euthymiae, we find many features shared with *Panamacris*, *Rhcnoderma*, *Cristobalina*, and *Mezentia*. The interocular vertex shows more or less definitely three groups of transversely disposed tubercles reminiscent of *Cristobalina*, the transverse carination of the clypeus is of the same character as that seen in the other genera, the cephalic margin of the pronotal disk is definitely emarginate mesad as in all the other American genera, and the general pronotal form and the shape of the caudal margin of the disk are reflected in *Mezentia*, while the numerous pronotal tuberculations are suggested in *Mezentia gibbera* and *Rhcnoderma (Lempira) archimimus*.

The very distinctive and characteristic structure of all the limbs is as in the other American genera of the Euthymiae, although the length reduction of the second caudal tarsal article is more marked than in any of these, but is equalled in certain Old World Euthymiae. The very unusual type of ultimate tergite (supra-anal plate) of the male is essentially what we find in *Mezentia*, in its very marked and characteristic prolongation distad into a lanceolate process.

Generic Characters.—Alate. Form slender. Surface in general smooth except for numerous tubercles on dorsum and lateral lobes of pronotum; thoracic venter and cephalic and median limbs sparsely hirsute, caudal tibiae markedly long hirsute, venter of abdomen distad definitely hirsute with a medio-longitudinal glabrous area; venter of thorax appreciably concave longitudinally. Fastigium markedly rostrate produced, distinctly longer than occiput, tapering distad to an acuminate or a subdeplanate and somewhat expanded obtuse apex, ventrad medio-longitudinally carinate, this forking proximad; transverse arcuate impression separating fastigium from occiput; face obliquely retreating in profile, in cephalic aspect broad; frontal costa obsolete ventrad of median ocellus; clypeus with transverse median carina pronounced and sharply cut; eyes elliptical in outline, moderately prominent; antennae 23-jointed, simple, rather heavy. Pronotum subcylindrical, moderately longitudinal, lacking median and lateral carinae; cephalic margin of disk obtuse-emarginate mesad, caudal margin broadly obtuse to sinuately arcuato-truncate; metazona comprising one-third total length of pronotum; transverse sulci at most but moderately impressed, the principal (caudal) one more definite than the others, the cephalic one not clearly cut; tubercles of dorsal surface and dorsal portion of lateral lobes pronounced, spaced and biseriate in emphasis (*mirabilis*) or less evident, less regular and not definitely biseriate in size (*dominans*); lateral lobes of pronotum longitudinally rectangulate, ventral margin sinuate in cephalic half. Tegmina reaching to apices of caudal femora, failing to reach apex of abdomen by approximately the pronotal length, narrow, lanceolate, margins subparallel, apex rounded; principal venation regular and longitudinal. Wings in repose reaching to tegminal apices, broad, subcycloid, peripheral margin evenly arcuate, apex not

produced. Prosternal process blunt subspiniform, moderately inclined caudad; mesosternum in male with interspace distinctly longitudinal, X-shaped; metasternal lobes in male attingent caudad. External auditory tympana present in extreme lateral section of proximal abdominal tergite. Ultimate tergite (supra-anal plate) of male broad in proximal half, elongate rostrate-produced distad, reaching to apex of ultimate sternite; cerci of male elongate, tapering, incurved at apices; ultimate sternite (subgenital plate) of male rostrate produced, carinate ventrad. Cephalic femora and tibiae short, robust, rhienodermoid, subdeplanate on flexor surfaces: median limbs short, stout, subcompressed, rhienodermoid, cephalic genicular lobe much larger than caudal one. Caudal femora elongate, slender, moderately compressed, dorsal carina paucispinulose, ventral margin entire, proximo-dorsal supra-coxal section of femur appreciably differentiated from remainder of dorsal outline, genicular lobes with apices weakly acute: caudal tibiae faintly compressed in proximal half, flexor surface deplanate; external spines on extensor surface seven in number, one apical; spines of internal surface ten in number, one apical; caudal tarsi elongate, slender, proximal and distal articles subequal in length, second slightly longer than half of either of the others.

Distribution.—British Guiana, Colombia (probably the upper Orinoco section) and western Costa Rica. But three definite records of the genus are known.

Key to Species

1. Fastigial process with its apex moderately expanded, broader than width of process at distal third, its apex obtuse-angulate as seen from dorsum. Major pronotal papilliform tubercles less strongly developed, smaller and less elevated, not contrastingly marked with fuscous. Tegmina of male narrower, greatest width four and one-half times in length of same; intercalated longitudinal nervures between principal longitudinal veins strongly marked, parallel and regular, areolation rectangulate and definite. Internal surface of caudal femora dull greenish with extreme base and distal fifth orange-red to carmine; caudal tibiae externally dull purplish, remainder carmine. (British Guiana and Colombia.)*dominans* Westwood
- Fastigial process with its apex not at all expanded, acuminate, in general tapering to the acute apex. Major pronotal papilliform tubercles more strongly developed, larger and more elevated, contrastingly marked with fuscous. Tegmina of male broader, greatest width contained not over four times in length of same; no definite direct and parallel intercalated longitudinal nervures present in the anastomosing irregular areolation between principal longitudinal veins. Internal surface of caudal femora dull carmine with genicular section very dark purplish olivaceous; caudal tibiae externally grayish olivaceous, elsewhere very dark purplish olivaceous. (Costa Rica.)
mirabilis (Bruner)

Bactrophora dominans Westwood. Plate 1, figs. 1 and 2; pl. 3, fig. 15.

1842. *Bactrophora dominans* Westwood, Arcana Entomol., I, p. 66, pl. 17, fig. 2.
[♀; Unknown locality.]

The female type of *dominans*, which is now in the British Museum of Natural History, I conclude from Westwood's figure had been dried from a liquid preservative, and the exceedingly brief and incomplete description is of little value without the accompanying illustration, which, however, permits relatively ready recognition of the species. I now have before me, thanks to the authorities of the above-mentioned institution, the male specimen from British Guiana belonging to them mentioned by Martínez.⁴¹ Below is given a description of the salient features of the species drawn from this individual.

The male specimen considered *dominans* by Martínez ⁴² and said to be from Santa Fé de Bogotá, Columbia, may be found to represent a third species of the genus, although it is inadvisable to name it without confirmatory comparisons. The figures and the very careful and detailed description of this Colombian specimen show certain differences from the available male, which is clearly Westwood's *dominans*, having been determined by Uvarov after comparison with the female type of the species, and no reason exists for questioning their identity. The Colombian male is figured as having the fastigium thicker transversely than in the British Guiana specimen, more decurved in profile and the apex hardly at all enlarged laterad, instead of being very appreciably broadened at the extremity, while the tegmina appear proportionately broader, although this may be due to their broken apices in the Colombian individual. The coloration of the latter specimen doubtless has been influenced by its prior preservation probably in alcohol, as suggested by Martínez, and certain tonal differences noted, such as the obscure red color of the tegminal spotting, are doubtless due to discoloration.

♂; "R. Paruni" (doubtless a transliteration error for Rupununi River), British Guiana. May 1916. (C. E. Bodkin.) [British Museum of Natural History.]

Description of male.—Size medium; form elongate subcylindrical; surface smooth except on pronotum, pleura, fastigium and face, the pronotum being tuberculate, the pleura cribroso-punctate, the fastigium sparsely micro-punctulate, the face very sparsely and obscurely shagreenous.

Head with fastigial process equal to three times the length of the normally exposed occiput, the latter subdeplanate; interspace between eyes equal to slightly more than two-thirds the proximal width of the fastigial process, transverse impression of the same area marked, caudad bordered by three spaced subobsolete tuberculations, and one additional one on each side near the eye margin: fastigium rounded in section dorsad and laterad, with greatest proximal width equal to one-third of its length, as seen from dorsum narrowing distad to the distal ninth, which is definitely and rather

⁴¹ Tomo Cincuentenario Mem. R. Soc. Españ. Hist. Nat., p. 504, (1921).

⁴² Idem, pp. 503-508, figs. 1 and 2.

sharply expanded laterad into nearly rectangulate lobations, the breadth of which is equal to two-thirds that of proximal width of the fastigial process, the apical margin of the fastigium obtuse-angulate,⁴³ at approximately proximal and distal thirds the surface bears dorsad and laterad very weak and subobsolete inequalities which merely break the even attenuation of the fastigium; ventral surface of fastigium bearing a very definite medio-longitudinal carina, reaching from the extreme apex proximad, forking briefly distad of the antennal insertions, on each side of this the surface is shallowly but progressively more broadly sulcate from the middle proximad to the antennal scrobes, at middle of fastigial length a tubercle is present on each side just dorsad of the sulcation; in profile the fastigium is faintly ascending with the immediate apex slightly up-turned; frontal costa obsolete, represented only by the few small tubercles which interantennally terminate the forking of the fastigial carina; face broad, lateral carinae subobsolete, weakly diverging ventrad. Eyes moderately prominent when seen from dorsum, in lateral view ovate, greatest depth equal to one and three-fourth times that of infra-ocular portion of genae. Antennae equal to approximately the combined length of head (with fastigium) and pronotum, faintly heavier at distal third than at proximal third.

Pronotum with lateral portions subparallel as seen from dorsum, greatest width equal to four-fifths of greatest median length, in lateral view seen to be but very faintly sellate; cephalic margin of disk with median emargination arcuately-obtuse, the bordering pair of lobules obtuse-angulate, definitely tuberculate on their dorsal surface, the cephalic margin laterad having on each side three spaced similar but progressively smaller lobules; caudal margin very broadly and weakly obtuse-angulate with several adjacent low tuberculations; cephalic transverse sulcus dorsad merely an impression, the second, third and fourth (principal) more evident, the last at approximately the caudal third, tuberculation of dorsal surface and dorsal two-thirds of lateral lobes pronounced, denser on metazona than elsewhere, occasionally more cicatriform than purely tuberculate, not markedly biseriate in development: lateral lobes of pronotum subrect-angulate, greatest depth equal to two-thirds greatest dorsal length of lobes; ventro-cephalic angle slightly acute, ventral margin appreciably concave in cephalic three-fifths, nearly straight oblique caudad, ventro-caudal angle obliquely truncate, caudal margin of lobes vertical, straight until dorsad it passes into the outline of the caudal margin of the disk.

Tegmina with greatest width contained four and one-half times in the length, the costal and sutural margins subparallel for the greater portion of their length: longitudinal veins strongly marked, evenly spaced and subparallel, intercalated accessory longitudinal nervures developed between the longitudinal veins, equidistant in position and of similar emphasis, all with numerous cross-veins dividing the areas into generally rectangulate areolets; marginal field with areolets more irregular than elsewhere, mediastine vein reaching only to two-fifths of tegminal length; anal field

⁴³ The whole development of the apex of the fastigium is such that before I saw the present male I was inclined to consider Westwood's drawing of this area due to a teratological condition. The present specimen proves this to be unfounded.

with venation and areolation as a whole very regular, less uniform only near the immediate sutural margin. Wings when expanded falling short of the tegminal apices by slightly less than half of pronotal length, the greatest breadth when expanded equal to approximately three-fourths of the alar length, apex bluntly rounded; radiate field with intercalated false nervures few, present only in the peripheral sections of the respective interspaces and not in all of them.

Prosternal process with its blunt apex well rounded; mesosternal lobes with their internal margins subobtuse-angulate, interspace with its cephalic portion reversed subtrigonal, the greatest (cephalic) width between foveolae equal to twice the length to point of least width, which latter is faintly more than one-third the cephalic width of interspace, caudal border of lobes arcuately diverging; metasternal lobes broadly attingent mesad, their accompanying foramina but narrowly separated, the two disposed in a transverse arcuate figure.

Penultimate abdominal tergite with a median distinct but rather shallow rectangulate emargination of the distal border, this flanked laterad by very small acute angles and more laterad by larger, more pronounced but depressed acute-angulate furcula-like projections; ultimate tergite (supra-anal plate) with scutellate proximal half broader than long, its lateral margins arcuate-convergent, its surface bearing a pair of obscurely indicated subparallel median carinulae, between which the surface is subconcave, the usual transverse arcuate ledge-like carina at distal third of proximal half of tergite, distad of this the median carinae are closer to one another and the more lateral areas with their surface more strongly concavo-excavate than proximad of the transverse carina; distal half of ultimate tergite narrow elongate, sublinguiform, acute, without definite surface sculpture, reaching to apex of ultimate sternite (subgenital plate): cerci reaching almost to apex of ultimate sternite, tapering, distal two-fifths moderately arcuate dorso-mesad: ultimate sternite (subgenital plate) decidedly compressed and quite sharply acute when seen from venter, seen in profile the apex is moderately acute, ventral carination of distal two-thirds of sternite marked, thence proximad the carina is divided and a pronounced medio-longitudinal concavity is present, which extends proximad across the three preceding sternites, flanked laterad on the more proximal two of these by definite fringing brushes of hairs.

Caudal femora slender, greatest depth contained slightly over six and one-half times in the length, supra-coxal lobule very distinct and definite, general shape, seen in profile, tapering but little to pregenicular section; dorsal carina and those bordering the pagina with a few weak serrulations, these very few on the ventral margin of the pagina; paginal pattern regular but weakly impressed, never more acute than obtuse-angulate; ventral surface relatively broad, but shallowly subsulcate: caudal tibiae with compression of proximal half appreciable but weak.

Coloration.—General base color of head, pronotum, pleura, sterna and limbs olive-citrine (of Ridgway) darkening to brownish olive on fastigium and tegmina, the abdomen with the normally exposed apex light brownish olive. Head with the proximal ventral grooves of the fastigium dull isabeline, face of the fastigial color, the pale color of the genae forming the

cephalad end of mustard yellow pale lateral bars which extend caudad across the ventral two-fifths of the lateral lobes, the pleura and the dorsal half of the external pagina of the caudal femora, becoming subobsolete distad in the same area; eyes sudan brown; antennae with proximal article dull isabelline, remainder dull blackish fuscous. Pronotum with olive-citrine of disk and dorsal three-fifths of lateral lobes slightly darker than that of occiput but not quite as blackish as the fastigium, the tubercles appearing as clear greenish-white vesicles. Tegmina blotched quite regularly with numerous in general roughly quadrate areas of pale ochraceous-salmon, both the arcolets and cross-nervures being involved, the longitudinal ones deep brownish olive. Wings with disk solidly cadmium yellow, the apex and a narrowing peripheral border of the radiate field infumate with prout's brown, this clouding not reaching the internal border of the wing, the similar but more narrow pencilling of the immediate costal margin not reaching proximad of the middle, distal portion of discoidal vein pencilled with prout's brown, radiate veins and cross-nervures within cadmium disk similarly colored. Abdomen with its normally covered areas ochraceous-tawny, weakly washed proximo-dorsad and proximo-ventrad with brazil red; most tergites narrowly bordered distad with blackish. Caudal femora with the bicolored longitudinal pattern (i.e. olive-citrine and mustard yellow) pronounced, the dorsal surface olive-citrine, the ventral surface entirely dusky dull green, the internal face of the same shade with that face of the genicular extremity, adjacent pregeniculate section and a narrow proximal border (as well as internal surface of coxae) brazil red, crossed at the narrowest point by a narrow band of dull green; caudal tibiae externally vinaceous-russet, internally dull brazil red, internal spines black-tipped, external spines pale olivaceous, black-tipped; caudal tarsi washed internally and touched externally with pale brazil red.

♂ (above described): length of body, 52 mm.; length of fastigium, 10; dorsal length of entire head, 13.2; length of pronotum, 7.3; greatest width of pronotum, 5.9; length of tegmen, 27; greatest width of tegmen, 5.9; length of wing, 24; greatest width of spread wing, 16; length of caudal femur, 18.6.

♀ type (ex Westwood): length of body, including fastigium, $3\frac{1}{2}$ inches; length of fastigium before eyes, $6/10$ inch; expanse of tegmina, 4 inches.

Distribution.—The locality from which the type came was not known. The specimen here recorded bears the most definite information we have on the species' occurrence. If, as I presume, the hand-written label "R. Paruni" on it, refers to the well-known great interior river of British Guiana, the Rupununi, along which in the past few decades the Rupununi cattle trail has been opened up, we have some concrete idea of the type of country inhabited. The Rupununi flows from interior grassland of difficult access through miles of dense Guianan forest until it joins the Essequibo. If *dominans* occurs in this forested territory it prefers a habitat very similar to that frequented by *B. mirabilis* in Costa Rica.

The specimen recorded by Martínez as *B. dominans* from "Santa Fé de Bogotá", Colombia, in every probability did not come from the vicinity

of that city, which is in a temperate region entirely different from the type of country elsewhere known to be inhabited by this and related genera. The elevation of Bogotá is 8750 feet and the environment is savanna land of pasture and planted fields, with no trees except introduced eucalypts (vide Chapman). Bogotá has served for decades as a distributing center for zoölogical material secured at lower levels in the Magdalena Valley to the west, in the upper levels of the Orinoco basin just across the Cordillera Oriental, and even from much more distant parts of Colombia to the north or south. No other locality in the world has been more productive of misleading geographic information than Bogotá, and unless supporting evidence as to the occurrence of a species there is available, the mere locality should be looked upon with suspicion. Dr. Frank M. Chapman, the ornithologist, in his great work on "The Distribution of Bird-Life in Colombia" has devoted a number of pages to a discussion of the misuse of "Bogotá" as a locality for zoölogical and specifically ornithological material,⁴⁴ and the unsupported locality label "Bogotá" on an insect is as open to question as it would be on a bird skin. From what we know of the Neotropical Euthymiae they are vine-inhabitants, preferably the hanging vines of lowland tropical forest. Everything points to *Bactrophora dominans* following the same preferences as its relatives, and the so-called Bogotá specimen in every probability came from either the lowland forest of the upper Magdalena to the westward or the Villavicencio or more eastern districts of the upper Orinocan drainage basin to the east of the Cordillera Oriental. Personally I feel the latter area was the original home of the specimen reported by Martínez. An important highway leads from Bogotá eastward across the Cordillera Oriental into this very different, much lower and distinctly tropical region.

Specimen examined: The single male above listed.

Bactrophora mirabilis (Bruner). Plate 1, figs. 3 and 4; pl. 3, fig. 15.

1905. *Scolocephalus mirabilis* Bruner, Entom. News, XVI, p. 314, pl. XI. [♂; Pozo Azul [de Pirris], Costa Rica.]

The unique type of Bruner's species is before me, from the Hebard Collection. The species is quite distinct from, but clearly congeneric with, Westwood's *dominans*, the more striking differential features being given in the key to the species of the genus.

In 1908⁴⁵ Bruner considered his species, and of course the genus *Scolocephalus*, to be identical with Westwood's *B. dominans*, but Kirby in his "Synonymic Catalogue of the Orthoptera"⁴⁶ decided the genera were

⁴⁴ Bull. Amer. Mus. Nat. Hist., XXXVI, pp. 11-14, (1917).

⁴⁵ Biol. Cent.-Amer., Orth., II, p. 250, (1908).

⁴⁶ Vol. III, p. 406, (1910).

distinct. A careful study, with both forms before me, shows this to be incorrect, although the species are very different.

♂ (*type*); Pozo Azul de Pirris, plains of the Rio Grande de Pirris, western Costa Rica. (C. F. Underwood.) [Hebard Collection, ex Bruner, Type no. 308.]

The following features are those showing noteworthy difference from *B. dominans*.

Size slightly larger; form somewhat heavier and more robust.

Head with interocular transverse impression between occiput and dorsal surface of fastigium but weakly arcuate, less so than in *dominans*, bordered caudad by three spaced groups of one or more low but distinct tubercles, with a single detached one on each side close to the caudal margin of the respective eyes: fastigium approximately two and one-half times the length of normally exposed occiput, in form subconical, tapering distad to a weakly blunted, not at all expanded but subacute apex, surface dorsad rounded transversely with very faint premedian and postmedian tumescence as in *dominans*; ventral carina as in *dominans* but proximal divided area somewhat longer and more sharply defined than in *dominans*, its marginal beaded tubercles more pronounced, although hardly at all more extensive ventrad as costal margins; in profile the fastigium is weakly ascending, nearly straight and not at all upturned near apex. Eyes slightly narrower and more elliptical than in *dominans*.

Pronotum with general structure as in *dominans* except for the deeper and narrower cephalic, yet obtuse, angulation of the cephalic margin of the disk, caudal margin of disk sinuately low arcuate; pronotal tubercles definitely of two size categories, the minor one proportionately as in *dominans*, the major, made up of the marginal and numerous of the discal as well as several dorsad on each of the lateral lobes, very appreciably larger and more elevated and generally contrastingly colored.

Tegmina in general form as in *dominans* but proportionately broader, the greatest, slightly post-median, width contained slightly less than four times in the length, the costal and sutural margins less obviously subparallel, apex more broadly and bluntly arcuate than in *dominans*; principal longitudinal veins slightly more radiating distad than in *dominans*, interspaces between same broader, and occupied by networks of many anastomosing veinlets without definite longitudinal intercalated elements as in *dominans*; mediastine vein divided and reaching to middle of tegmen (in *dominans* less definite and extending only to basal two-fifths); anal field irregularly multi-areolate. Wings as in *dominans* except that the interstices of the radiate field more frequently have intercalated median veinlets and these of greater length than in *dominans*.

Prosternal process more compressed than in *dominans*, apex slightly sharper. Interspace between mesosternal lobes at narrowest point proportionately less than in *dominans*, the more cephalic portion proportionately broader, in form virtually an equilateral triangle, more distad portion of internal margin of lobes in part obliquely subtruncate meso-caudad: metasternal lobes with their attingent sections proportionately shorter, a lanceolate inter-lobar wedge extending caudad some distance from the slightly narrower and more elongate foramina.

Penultimate abdominal tergite with median emargination of distal margin proportionately narrower, subeuneate in outline, its deepest point transversely truncate, but a single pair of bordering acute furculoid plates present, these much larger than either pair seen in *dominans*, deplanate and moderately diverging: ultimate tergite (supra-anal plate) with the transverse arcuate ledge somewhat less pronounced than in *dominans*, the median paired longitudinal carinae obsolete proximad of the arcuate ledge, moderately definite thence distad to the base of the distal rostrate section, the latter narrower and more sharply acuminate than in *dominans*: cerci proportionately somewhat shorter than in *dominans*, reaching distad only to middle of the acuminate distal half of ultimate tergite, falling appreciably short of the apex of the ultimate sternite, faintly less curved distad than in *dominans*: ultimate sternite (subgenital plate) slightly less compressed than in *dominans*, its ventral medio-longitudinal carina less marked and less elevated, in profile its distal outline somewhat more sharply acute.

Cephalic and median limbs slightly longer than in *B. dominans*; cephalic femora with internal genicular lobes slightly less acute; median femora with cephalic genicular lobes more broadly rounded: caudal femora as in *B. dominans*, greatest depth contained six times in length; caudal tibiae as in *dominans* except that the subcompressed proximal portion is somewhat more robust; caudal tarsi similar in proportions but slightly heavier in build.

Coloration.—In general buffy olive to brownish olive, the fastigium solidly nearer olive; pale lateral line less striking and less sharply contrasted than in *dominans*, honey yellow, on the caudal femora extending distad over the ventral half, instead of dorsal, of the external pagina. Eyes sudan brown; antennae largely russet, the proximal and second articles buffy olive, thence for an appreciable distance both dorsal and ventral surfaces of the antennae are medio-longitudinally sublineate with fuscous. Pronotum with most of the tubercles of the major category shining blackish. Tegmina without pronounced pattern but rather faint, usually intercalated and small subequally sized maculations of leaf green are seen on careful examination; principal longitudinal veins largely pencilled with cinnamon-brown. Wings with disk aniline yellow, the apical infuscation very weak and limited, not extending at all proximad on either the costal or peripheral margins, principal radiate veins distad pencilled with fuscous. Abdomen with distal segments quite solidly brownish olive, those more proximal tergites quite broadly barred transversely, distad on each tergite, withummy brown. Ventral surface tawny-olive to verona brown. Caudal femora on external face largely ivy green dulling in places to olive with the ventral half of pagina occupied by part of the pale lateral bars; internal face dull carmine with genicular area very dark purplish olivaceous, ventral sulcus very dully of the latter color: caudal tibiae very dark purplish olivaceous, washed externally with grayish olivaceous, internal spines black, external ones black tipped: caudal tarsi with the two surfaces much the same as the tibiae.

Length of body, 55 mm.; length of fastigium, 9.8; dorsal length of entire head, 13.2; length of pronotum, 8.2; greatest width of pronotum, 6.1;

length of tegmen, 27; greatest width of tegmen, 7; length of wing, 25.5; greatest width of spread wing, 17.5; length of caudal femur, 19.7.

Distribution.—The sole locality from which this very remarkable species is known is Pozo Azul de Pirris, western Costa Rica. This place is merely a very small cattle ranch near the upper border of the Llanos of the lower Rio Grande de Pirris, at the junction with that stream of the Rio Parrita. The elevation is quite low (about 300 feet above sea-level) and the environment is heavy forest, in the vine tangles of which *Bactrophora* doubtless lives. I visited Pozo Azul in the summer of 1927, a three-day journey in the saddle from San José, and one of my principal incentives was the present species. However, I was not fortunate enough to secure additional material of it. A description of Pozo Azul and its environment will be found in my narrative "Costa Rica Revisited."⁴⁷

Specimen examined: The unique male type.

EXPLANATION OF PLATES

PLATE 1.

- Fig. 1.—*Bactrophora dominans* Westwood. Dorsal view of male. Rupununi River, British Guiana. ($\times 1\frac{1}{2}$.)
 Fig. 2.—*Bactrophora dominans* Westwood. Lateral view of male. Rupununi River, British Guiana. ($\times 1\frac{1}{2}$.)
 Fig. 3.—*Bactrophora mirabilis* (Bruner). Lateral view of male (type). Pozo Azul, Costa Rica. ($\times 1\frac{1}{2}$.)
 Fig. 4.—*Bactrophora mirabilis* (Bruner). Dorsal view of male (type). Pozo Azul, Costa Rica. ($\times 1\frac{1}{2}$.)
 Fig. 5.—*Panamacris magnifica* (Hebard). Lateral view of male (type). Gatun, Canal Zone, Panama. ($\times 1\frac{1}{2}$.)
 Fig. 6.—*Panamacris magnifica* (Hebard). Dorsal view of male (type). Gatun, Canal Zone, Panama. ($\times 1\frac{1}{2}$.)

PLATE 2.

- Fig. 7.—*Cristobalina scollata*, new genus and species. Lateral view of female (type). San Cristobal, Chiapas, Mexico. ($\times 3$.)
 Fig. 8.—*Cristobalina scollata*, new genus and species. Dorsal view of female (type). San Cristobal, Chiapas, Mexico. ($\times 3$.)
 Fig. 9.—*Cristobalina sellata*, new genus and species. Lateral view of male (allotype). Chichen Itza, Yucatan. ($\times 4\frac{1}{2}$.)
 Fig. 10.—*Cristobalina sellata*, new genus and species. Dorsal view of male (allotype). Chichen Itza, Yucatan. ($\times 4\frac{1}{2}$.)

PLATE 3.

- Fig. 11.—*Panamacris magnifica* (Hebard). Portion of caudal femur of male (type), showing serrulate ventral margin. Gatun, Canal Zone, Panama. (Greatly enlarged.)
 Fig. 12.—*Cristobalina scollata*, new genus and species. Ventral aspect of sterna of female (type). San Cristobal, Chiapas, Mexico. (Greatly enlarged.)
 Fig. 13.—*Cristobalina sellata*, new genus and species. Ventral aspect of abdomen of female (type). San Cristobal, Chiapas, Mexico. (Greatly enlarged.)

⁴⁷ Year Book Acad. Nat. Sci. Phila., 1927, pp. 32-34.

- Fig. 14.—*Cristobalina sellata*, new genus and species. Cephalic view of head of female (type). San Cristobal, Chiapas, Mexico. ($\times 4\frac{1}{2}$.)
- Fig. 15.—*Bactrophora mirabilis* (Bruner). Ventral aspect of head and prosternum of male (type). Pozo Azul, Costa Rica. (Greatly enlarged.)
- Fig. 16.—*Rhcnoderma olivaceum* Gerstaecker. Cephalic view of head of female (type of *R. glabra* Bruner). Pozo Azul, Costa Rica. ($\times 3$.)

PLATE 4.

- Fig. 17.—*Rhcnoderma olivaceum* (Gerstaecker). Lateral view of female (type of *R. glabra* Bruner). Pozo Azul, Costa Rica. ($\times 1\frac{1}{3}$.)
- Fig. 18.—*Rhcnoderma olivaceum* (Gerstaecker). Lateral view of male (allotype). Pozo Azul, Costa Rica. ($\times 2$.)
- Fig. 19.—*Rhcnoderma olivaceum* (Gerstaecker). Dorsal view of male (allotype). Pozo, Azul, Costa Rica. ($\times 2$.)
- Fig. 20.—*Rhcnoderma humile* Rehn. Lateral view of male (allotype). Chará, Costa Rica. ($\times 2$.)
- Fig. 21.—*Rhcnoderma humile* Rehn. Dorsal view of male (allotype). Chará, Costa Rica. ($\times 2$.)
- Fig. 22.—*Rhcnoderma archimimus*, new species. Lateral view of female (type). Subirana, Honduras. ($\times 2$.)

PLATE 5.

- Fig. 23.—*Rhcnoderma archimimus*, new species. Lateral view of male (allotype). Subirana, Honduras. ($\times 2$.)
- Fig. 24.—*Rhcnoderma archimimus*, new species. Dorsal view of male (allotype). Subirana, Honduras. ($\times 2$.)
- Fig. 25.—*Rhcnoderma archimimus*, new species. Dorsal view of female (type). Subirana, Honduras. ($\times 2$.)
- Fig. 26.—*Rhcnoderma arcanum*, new species. Dorsal view of female (type). Cantarranas, Honduras. ($\times 2$.)
- Fig. 27.—*Rhcnoderma arcanum*, new species. Dorsal view of head and thorax of female (type). Cantarranas, Honduras. ($\times 4$.)
- Fig. 28.—*Rhcnoderma humile*, new species. Cephalic view of head of male (allotype). Chará, Costa Rica. ($\times 4\frac{1}{2}$.)
- Fig. 29.—*Rhcnoderma archimimus*, new species. Cephalic view of head of male (allotype). Subirana, Honduras. ($\times 4\frac{1}{2}$.)
- Fig. 30.—*Mezentia visenda*, new species. Cephalic view of head of male (type). Yurimaguas, Peru. ($\times 6$.)

PLATE 6.

- Fig. 31.—*Mezentia cutleri*, new species. Dorsal view of female (type). Lancetilla, Honduras. ($\times 1\frac{1}{2}$.)
- Fig. 32.—*Mezentia visenda*, new species. Lateral view of male (type). Yurimaguas, Peru. ($\times 2\frac{3}{4}$.)
- Fig. 33.—*Mezentia visenda*, new species. Dorsal view of male (type). Yurimaguas, Peru. ($\times 2\frac{3}{4}$.)
- Fig. 34.—*Mezentia acanthopyga*, new species. Lateral view of male (type). Teffe, Amazonas, Brazil. ($\times 3$.)
- Fig. 35.—*Mezentia acanthopyga*, new species. Dorsal view of male (type). Teffe, Amazonas, Brazil. ($\times 3$.)
- Fig. 36.—*Mezentia acanthopyga*, new species. Cephalic view of head of male (type). Teffe, Amazonas, Brazil. ($\times 4\frac{1}{2}$.)

PLATE 7.

- Fig. 37.—*Mezentia cutteri*, new species. Lateral view of female (type). Lancetilla, Honduras. ($\times 1\frac{1}{2}$.)
- Fig. 38.—*Mezentia cutteri*, new species. Cephalic view of head of female (type). Lancetilla, Honduras. ($\times 4$.)
- Fig. 39.—*Mezentia cutteri*, new species. Ventral aspect of apex of abdomen of female (type). Lancetilla, Honduras. (Greatly enlarged.)
- Fig. 40.—*Mezentia visenda*, new species. Lateral view of apex of abdomen of male (type). Yurimaguas, Peru. (Greatly enlarged.)
- Fig. 41.—*Mezentia acanthopyga*, new species. Lateral view of apex of abdomen of male (type). Teffe, Amazonas, Brazil. (Greatly enlarged.)
- Fig. 42.—*Mezentia visenda*, new species. Dorsal view of apex of abdomen of male (type). Yurimaguas, Peru. (Greatly enlarged.)
- Fig. 43.—*Mezentia acanthopyga*, new species. Dorsal view of apex of abdomen of male (type). Teffe, Amazonas, Brazil. (Greatly enlarged.)

A NEW PROCRYPTIC PHASMID FROM CUBA
(ORTHOPTERA: PHASMATIDAE)

BY JAMES A. G. REHN.

Dr. S. C. Bruner, of the Estacion Experimental Agronomica, at Santiago de las Vegas, Cuba, sometime past sent to me for study a single individual of a most interesting procryptic phasmid species belonging to the genus *Hesperophasma* (= *Phantasis* Saussure, not of Thomson). The specimen was the property of Hermano Clemente, of the Colegio de la Nuestra Señora de la Caridad, Santiago de Cuba, who had permitted Dr. Bruner to send it to me for study. The species was found to be undescribed, and through the kindness and interest of Hermano Clemente the unique type of this most striking and interesting member of a genus quite rare in collections, has been placed in the collection of this Academy.

Hermano Clemente has informed Dr. Bruner that the specimen was taken in a deep and very damp ravine, on the decayed trunk of a dead tree, in thick undergrowth largely of ferns. The Loma de San Juan, the type locality, is in the Sierra del Cobre, opposite the Loma del Gato, a locality from which Prof. Bruner has sent to me a number of novelties shortly to be described.

*Hesperophasma*¹ *ccrd:ferum*,² new species

This species is more nearly related to *H. lyratum* (Bolivar)³ than to any other member of the genus, and needs comparison solely with that form. It chiefly differs from *lyratum* in the broader mesonotal expansion, which is wider than the length of the mesonotum, instead of slightly less as in *lyratum*, in the strongly marked lateral laciniate lobations of the seventh abdominal tergite (in this much as in *H. saussurei* (Bolivar) and the definitely longer cephalic femora, which are but very slightly shorter than the length of the mesonotum (over four-fifths the same), instead of but two-thirds as long as in *lyratum*.

Type.—♀ : Loma de San Juan, Sierra del Cobre, Oriente Province, Cuba. Elevation, 3000 feet. August, 1932. (Collected by Hermano Alfredo Victor.) [Academy of Natural Sciences of Philadelphia, Type no. 5580.]

¹ This generic name was proposed in 1901 (Rehn, Canad. Entom., XXXIII, p. 271) to replace *Phantasis* Saussure, 1870, which is preoccupied by *Phantasis* Thomson, 1860, in Coleoptera.

² In allusion to the cordate or heart-shaped expansion of the mesonotum.

³ *Phantasis lyrata* Bolivar, Mém. Soc. Zool. France, I., p. 137, (1888). [♀ ; Cuba.]

Size medium; general form as usual in genus, the body appreciably depressed and subexpanded; surface spinose, tuberculate and lobulate, with lateral lacinate lobations on the mesonotum and certain abdominal tergites, limbs multilobulate.

Head with dorsal surface having low paired tubercles and subdeplanate cephalad of paired auriculiform occipital appendages, latter with apices extending but faintly caudad of caudal border of head, acute, serrulate along dorsal ridge, internal and external surfaces of appendages spinoso-

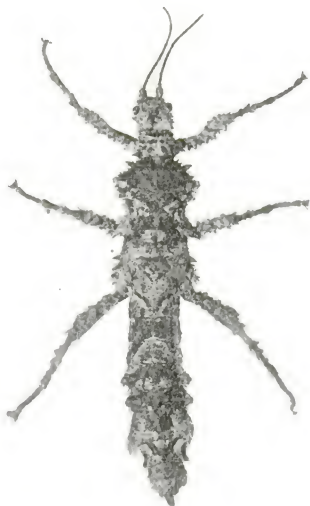


Fig. 1.—*Hesperophasma cordiferum*, new species. Dorsal view of female (type). Loma de San Juan, Sierra del Cobre, Oriente Province, Cuba. (Natural size.)

tuberculate, the lobes somewhat divergent disto-caudad as seen from dorsum; a definite postocular series of spinose tubercles present: eyes almost circular in basal outline, their depth contained nearly twice in infra-ocular depth of genae, moderately prominent when seen from dorsum. Antennae incomplete, fourteen articles present, proximal article strongly depressed, expanded, dorsal surface and external margin tuberculate, third article and succeeding ones elongate, from approximately sixth distad progressively increasing in length as far as preserved, surface brevi-subchaetulose.

Pronotum transversely subrectangulate, its greatest median length equal to five-eighths the width at cephalic border and less than half the width across the caudo-lateral spines: cephalic margin distinctly concave; caudal margin straight; lateral margins concavely expanding caudad with five regular spinose tubercles, the caudal one far larger than the others and dentiform; surface of prozona with a median paired series of tuberculations, the cephalic pair, which is distinctly caudad of the cephalic margin, far larger than the other four pairs, the more caudal ones of which regularly diverge caudad and adjoin the caudal margin, surface between median paired series and lateral tubercles with several others of the same character on each side. Mesonotum markedly expanded cephalad, its greatest width there slightly greater than median length of mesonotum (as 10 to 8.5), greatest width at caudal margin equal to hardly more than three-fourths the median length (as 6.7 to 8.5); expansion definitely heart-shaped, lateral margins as seen from dorsum sharply but obliquely expanding from cephalic margin to widest point, which is at cephalic third, then regularly but somewhat less sharply narrowing caudad, the outline of the area being carried upon the mesonotal disk by disconnected series or groups of tubercles, terminating caudad near the caudal margin in a pair of converging lamellae with serrulato-tubercular borders; lateral borders of the pronotum as far as they form part of this heart-shaped area armed with laterad-directed compound tubercles or lacinate lobate lamellations, caudad of this area the lateral margins of the mesonotum each bear a single group of low tubercles, and near the transversely truncate caudal margin on each side there is a single spaced bluntly uncinately tubercle: surface of mesonotum in the heart-shaped expanded area moderately inflated, particularly cephalad, with a central subdeplanate section outlined cephalad and laterad by a closely placed or even contiguous series of tuberculations, which follow in disposition the general outline of the same portion of the mesonotum, but not fully completing the cordiform figure, as the converging more caudal sections of the same are incomplete, being quite sharply broken up into scattered and somewhat irregularly disposed single tubercles; a transverse row of spaced and strong conically erect tubercles is placed between the cephalic border and those forming the cephalic section of the cordiform discal figure. Metanotum transversely subrectangulate, twice as broad as long, almost entirely coalesced with the proximal abdominal tergite (median segment); surface with cephalic and caudal median groups of about four paired low tubercles each, the caudal group less extended and more evident. Mesopleura as seen from dorsum with their lateral margins laciniately spinosolobulate, dorsad of which is a single large, laterad directed, faintly recurved spinose tubercle. Metapleura armed much as mesopleura, but lobulations more extensive and more prominent, while the single spine is proportionately more cephalad in position, stouter, subdepressed and definitely subuncinate toward apex. Ventral surface of thorax very definitely subconcave, its surface unarmed except for fine granulations which, however, are absent mesad; prosternum strongly transverse, greatest width nearly twice length, trapezoidal in outline, greatest breadth caudad. Mesosternum broad linguiform, its greatest width contained one and one-half times in greatest length (as 10 to 6.6), greatest width faintly cephalad of middle, the lateral margins decurved, regularly supplied with brief serrato-lobulations and

intercalated tubercles, seen from venter faintly converging thence caudad to shallow juxta-coxal emarginations, while cephalad they arcuately converge to a relatively narrow transversely truncate cephalic margin; surface of mesosternum with its cephalic third cut off from the remainder by a definite surface fold of a very broad and shallow V-shape and with its apex broad, less clearly marked and caudad in position; another low transverse surface elevation connects the foramina which are caudal in location. Metasternum subhexagonal in outline, the cephalic and caudal margins straight transverse, the latter about five-sevenths the breadth of the former, lateral margins with cephalic three-fifths moderately concave divergent caudad, decurved and serrato-lobulate like those of mesosternum, caudal two-fifths sharply concave convergent about coxae, simple, not lobulate or decurved; surface of metanotum with foramina widely separated.

Abdomen with each tergite bearing on the median line cephalad a pair of well-spaced simple low tubercles and caudad on each a closely placed pair of spiniform caudad-directed lobules, these latter less evident on proximal tergites, more pronounced and somewhat elevated on the seventh to ninth tergites; laterad of the median group the more proximal tergites (i.e. to sixth) bear paired sinuate carinate rugae, which near the distal margin of each tergite involved are elevated in usually serrate lobules, distad of the sixth tergites these structures are obsolete; general surface of tergites with numerous low tubercles and areas of asperities, usually of regular distribution; lateral margins of tergites straight and parallel on second and nearly so on third, becoming slightly extended on fourth, progressively laciniately lobate on fifth and sixth and subauriculiform lamellato-lobate on the seventh, the strongly marked marginal expansions straight oblique expanding cephalad and deeply excised laciniate caudad, this latter portion extending distad nearly as far as the middle of tergite eight, which is thus flanked on each side, eighth and ninth tergites distinctly narrower than seventh with lateral margins concave, briefly acute laciniato-lobate caudad, tenth tergite with lateral margins roundly sublobate; eighth tergite but two-thirds as long as seventh, two and one-half times as broad as median length, ninth tergite not more than two-thirds as long as eighth, slightly narrower, tenth nearly as long as eighth. Ultimate tergite (supra-anal plate) very brief, transverse trigonal, only a fourth as long as tenth, tectate. Cerci hardly longer than ultimate tergite, stout, apex bluntly acute with several surface micro-tubercles. Ultimate sternite (subgenital plate) moderately surpassing apex of ultimate tergite, deplanate, evenly acute lanceolate by convergence of lateral margins, apex narrowly transverse truncate, ventral surface distad with a finely indicated medio-longitudinal carinula.

Limbs multilobate on almost all carinae of both femora and tibiae: cephalic and median coxae each bearing a marked spiniform process immediately caudad of the trochanter articulation. Cephalic femora in length nearly equal to mesonotal length and subequal to that of metanotum, in general appearance subclavate, with flexure pronounced, occupying the proximal five-eighths of the entire femur, dorso-cephalic carina distad and ventro-caudal throughout multilobate, dorso-caudal carina distinct and lobate only distad, extending proximad as a series of spaced low tubercles, ventro-cephalic carinula distinct but weak; cephalic tibiae six-sevenths as long as femur, subclavate distad, dorsal carinae with two pair of marked

proximal angulate to subuncinate lobes. Median femora but slightly exceeding in length that dimension of the metanotum, deplanate ventrad, carinae very definitely multilobate; median tibiae much resembling cephalic pair but with a single pair of proximal lobations dorsad. Caudal femora slightly longer than mesonotum, appreciably compressed, dorso-caudal carina markedly crosso-lobate, ventro-cephalic similarly developed but with this structure abruptly excised in distal sixth, dorso-cephalic carina represented only by a brief lobate remnant distad, ventro-caudal carinula continuous but unarmed and very weak, ventral surface of femora distad with six or seven spaced acutely dentiform tubercles, two on each side and two or three in the middle, the cephalic ones being on the ventral surface of marginal lobes; caudal tibiae appreciably compressed, the dorso-caudal carina strongly and regularly uncinately lobate (three very marked), the dorso-cephalic represented only by a few lobiform tubercles, the ventro-cephalic carina regularly multilobate; caudal tarsi equal to five-eighths the length of the tibiae.

General dorsal and limb coloration fuscous, quite solid on the cordiform mesonotal figure, paling in some areas to prout's brown and even ochraceous-tawny, the whole to a greater or lesser degree washed, clouded or sprinkled with grayish white or pure but dull white, sometimes to the extent that the underlying fuscous is hardly or not at all evident, portions of the caudal section of the mesonotal cordiform figure quite definitely pencilled with white. Sternal surface ochraceous-tawny, becoming tawny on abdomen. Eyes prout's brown. Antennae grayish fuscous.

Length of body, 51.5 mm.; length of pronotum, 2.93; length of mesonotum, 9.6; greatest width of mesonotum, 11; length of metanotum (including proximal abdominal tergite), 8.1; greatest width of seventh abdominal tergite, 8.4; length of cephalic femur, 8.3.; length of median femur, 6.8; length of caudal femur, 10.1.

The type of this most striking species is unique.

ON THE RACES OF DRYOBATES HARDWICKII IN SIAM

BY RODOLPHE MEYER DE SCHAUENSEE.

In Siam there appear to be two races of Pigmy Woodpecker. One occupies the north of the country and extends southward down the Malay Peninsula as far as Nakon Sritamarat, Trang and Patani. This is *Dryobates hardwickii canicapillus* (Blyth), described from Ramree Island, Arakan.

From South Tenasserim (Malewoon), Hargitt (Ibis 1881, p. 599) has described *pumilus* as differing from *canicapillus* by having the four central rectrices black, and by being smaller "alae 2.78", or about 71 mm. From the material at hand, *pumilus* cannot be upheld. The character of the four central rectrices unspotted is not constant and the difference in size is but an average one.

North Siamese birds which are here regarded as typical of *canicapillus*, measure as follows:

3 ♂ 82-91 mm. (average 86.5)

9 ♀ 83-93 mm. (average 86.3 mm.)

6 ♂, 4 ♀, 1 no sex, collected by Gyldenstolpe (Kungl. Sv. Vet. Akad. Handl. 56, no. 2, p. 93) in north Siam measure from 79 to 87 mm. with an average of 82.4 mm. This gives an average for 21 north Siam specimens of 84.8 mm. with a range of 79 to 93 mm.

Birds from central and western Siam south to Nakon Sritamarat in peninsular Siam, measure:

7 ♂ 81-83 mm. (average 82 mm.)

2 ♀ 83-84 mm. (average 83.5 mm.)

Hume (Stray Feathers VI, p. 126) gives measurements for eleven birds from Victoria Point, Malewoon, Mergui Amherst, Thatone and Myawadee, as ranging from 3 in. (76 mm.) to 3.3 (84 mm.) with an average of 3.173 (about 81.5 mm.)

Robinson and Kloss recorded two birds from Tung Pran, and Namchuk, Pakehan Estuary, with wings of 84 and 82 mm., and a bird in the Academy's collection from Nakon Sritamarat measures 81 mm. These localities are in Peninsular Siam.

While none of these specimens attains the wing length of certain more northern birds, the overlapping is so great that the recognition of *pumilus* would serve no purpose. Northern birds measure 79 to 93 mm. as against 76 to 84 mm. for the more southern birds.

In the east of Siam *canicapillus* is replaced by a very well marked form. In the eastern bird the black portions of the upper parts are much browner, and, when compared with a series of northern and western birds, look brown instead of black. The red streak on either side of the crown is more extensive and paler. The black streaks on the lower surface are browner and narrower, and much less well defined. In measurements it does not differ from *canicapillus*, the wings of ten specimens ranging between 77 mm. and 87.5 mm.

From *Dryobates hardwickii auritus* (Eyton) of the Malay States, this new form is easily distinguishable by having the upper parts much more heavily barred with white.

For this East Siamese bird I propose the name of . . . *Dryobates hardwickii delacouri*,¹ subsp. nov.

Type adult male, A.N.S.P. No. 127220 collected at Ubol-Chanuman (about 15½° N. 105° East), east Siam, by Lucas Bah, on January 7, 1936. Wing 81.5 mm., culmen 14 mm.

Material examined:

D. h. canicapillus, one specimen from Thounghoo; twenty specimens from northern, western and peninsular Siam.

D. h. auritus, three specimens from the Malay States (Perak and Pahang).

D. h. delacouri, ten specimens from Ubol Khulu, Ubol-Chanuman and Sriracha, eastern and south-central Siam. Sriracha is south of Bangkok on the east side of the inner gulf. The wings of four males measure 79 to 86 mm. (average 83.7 mm.); those of six females 76 to 87 mm. (average 82.3 mm.)

Remarks:

The range of this new form in Siam appears to be from Sriracha eastwards probably into Indo-China in Cambodia, CochinChina, southern Annam and southern Laos.

Delacour and Jabouille (Ois. Ind. Ch. Fr. II, p. 219) say that *D. h. obscurus* is separable from "*canicapillus*" "par la teinte générale de ses parties supérieures, qui est nettement noire et non brunâtre." The range in Indo-China of this brownish bird is given by them as in the paragraph above.

One bird in the Academy's collection from Loi Mwe, Keng Tung, South Shan States (wing 91 mm.) differs from north Siam birds in having the upper tail coverts practically black, instead of spotted with white and probably is nearest to *obscurus* La Touche, which ranges from southern Yunnan to Tonkin and northern Laos.

¹ Named in honor of my friend, Jean Delacour, of Clères, France.

Ticehurst (Journ. Bomb. Nat. Hist. Soc. XXXVI, p. 933), reports on two pairs of *canicapillus* collected in southern Arakan, one pair on the Taungup-Prome road (2,900 feet) and the other at Chaungri Chaung (120 feet). The pair from the lowlands differed from the hill specimens "in having, like the rest of Burmese birds, sharper and finer streaks on the underparts." He makes no mention, however, of any difference in color. Unfortunately he gives no measurements.

In Siam there is a certain amount of individual variation as to the amount of streaking of the lower parts, and birds from higher altitudes, 4,000 to 6,400 feet, can be matched by lowland birds.

**THE OCCURRENCE OF FLINTS AND EXTINCT ANIMALS IN PLUVIAL
DEPOSITS NEAR CLOVIS, NEW MEXICO. PART VI,—
REPORT ON FIELD SEASON OF 1937**

BY J. L. COTTER.

INTRODUCTION

Work was continued at the Gravel Pit between Clovis and Portales, New Mexico, during the summer of 1937 under the joint auspices of the University Museum and the Academy of Natural Sciences of Philadelphia. At the same time work in the caves of the Guadalupe Mountains was continued, particularly at Burnet Cave, west of Carlsbad. Mr. C. B. Schultz, at present Assistant Director of the State Museum of the University of Nebraska, and Mrs. Schultz joined the party to work in Burnet Cave, and a separate report of this work, it is expected later on, will supplement previous publications on this site. Individual contributors to the field work of the Academy included: Mrs. John Penn Brock, Mr. Ambrose C. Cramer, Mr. George Murnane, Mr. Radcliffe Cheston, Jr., Mr. Robert Reeves Solenberger, and Mr. William T. Clarke, Jr., to whom grateful acknowledgment is hereby made.

The work at the gravel pit represented the fourth year of excavation at this site, and while no new facts came to light the results corroborated our previous observations and added evidence which lends weight to the conclusions already drawn in previous publications.

Mr. Cotter deserves credit for his patience and enthusiastic interest in systematically carrying on the excavations at this site, in order to obtain every scrap of evidence that would help to clear up the problem confronting us.

While there is no longer any doubt as to the association of Man and the extinct fauna which has been discovered in a number of places in North America, the age of such associations is still unsettled. This would appear to be the most important phase of the problem to be solved at this time, and undoubtedly will be a factor of increasing interest to geologists and other scientists who have been actively engaged in work of this nature.

EDGAR B. HOWARD

From June 13 to August 13, 1937, work was continued at the Gravel Pit site, between Portales and Clovis, New Mexico. Excavation was in charge of John L. Cotter, of the Academy, under the supervision of Dr. Edgar B. Howard, then Acting Curator of Geology and Paleontology. The party consisted of William T. Clarke, Jr., of the Academy of Natural Sciences, who was engaged in invertebrate research at the pit and elsewhere in Texas and New Mexico, Malcolm Bull, West Texas State Teachers College, Alexander B. Brock, Williams College, George Murnane, Harvard University, George

Cheston, also of Harvard University, Ambrose C. Cramer, III, Yale University, and Robert R. Solenberger, University of Pennsylvania.

Since previous investigation had resulted in the discovery of portions of two mammoth skeletons and considerable bison material, together with numerous artifacts at the southwest corner of the the Gravel Pit,¹ it was thought advisable to continue prospecting in this vicinity. Since the southern end of the west wall had been excavated until considerable overburden was left, it was necessary to remove the remainder of the original gravel dump so that work could be resumed. An area 80 x 30 ft. was cleared to the top of the bluish clay which constitutes the beginning of the layer of occupation. Of this area, gridded into sections measuring five feet on a side, the rows A and A' (Text-plate) just west of the 1936 excavation, were excavated, representing an area 10 x 80 ft. Contiguous northward and east of this rectangle an area comprising 725 square feet was laid out and excavated, after prospects seemed to merit investigation beyond the area first described.

Results of these latest efforts at the Gravel Pit, although not as unusual as those of 1936, were valuable in substantiating and completing evidence previously determined. Of the greatest significance was the finding of ample evidence to link *Bison taylori* remains with man-made implements of chalcedony, nominally of the "Folsom" type. Previous efforts had revealed artifacts chiefly with mammoth remains, although in 1934 Dr. Howard and his party located several artifacts as well as much bison material in the bluish clay at the east side of the Gravel Pit.²

Since observations in Parts I, II, III, and IV of this series have described the characteristic depositions revealed at the Gravel Pit, the terminology used in the present report will be, for the most part, self-evident.

As before, the succession of levels at the site was as follows: (1) surface of old erosion basin (in which the Gravel Pit is located) to three feet, brown sand; below this (2) the bluish clay, with minor variations in color and texture, extends to about six feet. Below the bluish clay is (3) a speckled sand, indurated in spots, to a depth of about eight feet. Further down a progressively coarsening gravel is encountered. Faunal associations are clearly defined in each stratum, although no one species is associated exclusively with a single level. The blue clay has yielded bison remains generally scattered throughout, but more concentrated in the lower third of the layer where distinct tracts of carbonized vegetal matter occur. Folsom lithic artifacts are scattered generally throughout the bluish clay. The

¹ The Occurrence of Flints and Extinct Animals in Pluvial Deposits near Clovis, New Mexico, Part IV.—Report on Excavation at the Gravel Pit, 1936. See these Proceedings 1937, pp. 1-16.

² Howard, E. B., Evidence of Early Man in North America. The University Museum Journal, Vol. XXIV, Numbers 2-3. Phila., 1935.

lowest portion of the bluish clay characteristically envelops the top portions of larger mammoth bones, the bottom halves of which are almost invariably sunk in the speckled sand beneath. This year a horse cannon bone was located in close proximity to a mammoth pelvis in the bluish clay-speckled sand contact line. In the speckled sand mammoth bones of various sizes are found, with some bison traces. Horse bones have been located deep in the speckled sand, as have tortoise carapaces. In several instances on the bottom contact of the speckled sand, horse teeth and other horse bones have been recovered. In almost every case, it could be observed that the weightiest bones had sunk farthest towards, and into, the speckled sand. None, however, penetrated to the gravel below.

Fauna.—This season, five *Bison taylori* skulls in which horn cores were preserved were recovered from the northern extension of the main excavation (Text-plate). These skulls lay just at the contact of bluish clay and speckled sand, with the bulk characteristically in the sand. Associated with these finds were a mammoth femur and two tibiae, a pelvis, fibula, several vertebrae, and many ribs and foot bones, all of mammoth. In the west end of the main pit (section A-4 and A-5) a mammoth tusk with tip intact lay in a diagonal position with the proximal portion in contact with the bluish clay, and the distal end buried three feet in the speckled sand.

In most instances the disarticulated and scattered bison bones in the bluish clay were too fragile or crushed for recovery. One small bison skeleton was uncovered, however, which was clearly traceable, and which included some thirteen articulated vertebrae and twelve ribs, a femur, two humeri, and a skull. The vertebrae and ribs were preserved *en bloc* and shipped, with other salvable bison and mammoth bones to the Academy.

Artifacts.—Finds of man-made implements this season included a small, unchanneled "Folsom-like" point of gray chalcedony located 4 ft. 6 in. from the surface in bluish clay containing scraps of bison bones. The point was 10 in. above the bluish clay contact with the speckled sand. A second artifact, a gray chalcedony knife, was located *in situ* one inch below the brown sand-blue clay contact and 28 in. above the speckled sand contact.

The most definite association of a Folsom point with bison so far noted at the Gravel Pit was located in Section C' 15. In this case the point lay half an inch under the wing of a bison atlas, in such close proximity that it was possible to preserve bone and point intact in the sand matrix. The atlas manifests a peculiar pathological aspect suggesting an arthritic condition. The point, which has never been removed from the matrix, is undoubtedly of the Folsom pattern, with evidence of channeling at the base of the exposed face.

A large true Folsom point of gray chalcedony with extensive channeling on both faces was recovered in excavated material, ostensibly from bluish

clay, as was a point of the Yuma design. A small, crudely-made Folsom was recovered from Section A-14-S beneath mammoth ribs approximately 1 ft. below the top contact of the speckled sand.

In reference to artifact finds made at the Gravel Pit, the writer was informed by a visitor, Mr. Joe Green of Hereford, Texas, of a find which he made shortly after the departure of the 1936 party. Mr. Green stated that in examining the rain-eroded portion of the west wall, about thirty feet from the northwest corner in the bluish clay, he noted a flint point lodged firmly in a bison vertebra which lay *in situ*. Lacking means of securing the point and vertebra intact, Mr. Green, who is an ardent collector of arrowheads, picked the point out of the vertebra and added it to his collection. The point, as observed by the writer, is a small true Folsom with delicate channeling on either face, a marginal retouch and a concave base with lateral edges ground. The material is the familiar gray chalcedony. The writer, who has come to know Mr. Green and to recognize his reliability as an observer, is personally convinced of the authenticity of the association, although the evidence is unfortunately destroyed.

In conclusion, a few observations on the typology of the Folsom type points so far found in the Gravel Pit strata seem to be in order. From the results of last year's work (Part IV of the present series), it is evident that the chalcedony points associated in speckled sand with mammoth bones were typically long and heavy for the Folsom pattern, with very slight channeling at the base. This year, finds made in the bluish clay associated with bison bones were typically of a slighter design, with and without channeling. It may not be amiss to suggest here that a difference in "calibre", *i.e.*, weight and dimensions, is evident in weapon points of the Folsom Complex, presumably dependent upon intended use; the heavier and larger points evidently being intended for the mammoth, the medium-sized points with more extensive channeling for bison and game of moderate size, and the "midget" points, of which one example is known from the Gravel Pit, for whatever small game there was. The small point in question, which is generalized Folsom in outline, but has little more than basal thinning, is illustrated as Fig. 5 in Plate 4 of Part IV of this series. (These Proceedings 1937).

No further occurrence of bone artifacts was noted during the 1937 excavation.

**THE OCCURRENCE OF FLINTS AND EXTINCT ANIMALS IN PLUVIAL
DEPOSITS NEAR CLOVIS, NEW MEXICO. PART VII,—
PLEISTOCENE MOLLUSKS FROM THE CLOVIS
GRAVEL PIT AND VICINITY**

BY WILLIAM T. CLARKE, JR.

The Pleistocene mollusks secured during the summer of 1937 were collected from the following sites: Clovis Gravel Pit, located in Blackwater Draw between Portales and Clovis, New Mexico, west of U. S. Highway 70; Anderson Basin, eleven miles due south of Clovis, New Mexico; the Eastern New Mexico State Park, between Portales and Clovis, east of U. S. Highway 70; and one-half mile south of the Clovis Gravel Pit road and three-quarters of a mile west of U. S. Highway 70, in a wind-formed basin.

The Clovis Gravel Pit and Anderson Basin specimens were found to be in place, while the specimens collected from the wind-formed basin sites were surface finds.

I collected specimens from the east and southeast corner of the Clovis Gravel Pit out of the medium light blue-gray clay stratum. This stratum is described in full by Dr. Ernst Antevs in his article, "Age of the Clovis Lake Clays" (Part II of this series), published October 10, 1935, in the Proceedings of this Academy.

In listing the species, I have placed them under the general type of habitat in which they are usually found today.

Commonly found under debris of flood plains: *Gastrocopta armifera* (Say), *Gastrocopta procera* (Gld.), *Strobilops texasiana* Pils., *Strobilops labyrinthica* (Say), *Hawaiiia minusculus* (Binn.), *Vallonia gracilicosta* Reinh., *Pupoides marginatus* (Say), and *Retinella electrina* (Gld.). Commonly found in inland lakes: *Gyraulus parvus* (Say), and *Lymnaea obrussa* Say. Commonly found in small streams with mud flats: *Physa gyrina* Say.

The mollusks at the extreme southeast corner of the pit were exceptionally plentiful, but from this corner and along the east wall they decreased in numbers rapidly, until at the extreme northeast corner they were entirely lacking. The north, west, and south walls of the Gravel Pit, except the small portion of the south wall in the southeast corner, lacked mollusks completely. Test pits were made in each wall at various intervals to make positive the absence of molluscan remains.

I have come to the conclusion that either the conditions at one time in the southeast corner of this site were favorable for the abundant existence

of these mollusks, or there was a drying-up condition that caused the creatures to congregate in this corner of the site, which possibly retained the remaining moisture before complete desiccation. Drainage from the southeast corner of the area at this point could cause the abundant congregation of mollusks there. The second conclusion presented seems to be the more logical one, as compared with recent conditions that I have had the opportunity to observe. I have seen small pools and streams that were prolific in mollusks, but in certain seasons of the year became completely dried up, leaving but a few dead shells on the surface. Then in the wet seasons the same pools and streams were again alive with mollusks. A definite conclusion can hardly be derived until further study of the entire surrounding region has been made. For information in regard to the climatic conditions of this region and its effects on the molluscan fauna I refer to Dr. Edgar B. Howard's paper, Part I, "The Occurrence of Flints and Extinct Animals in Pluvial Deposits near Clovis, New Mexico" (Part I of this series), in which Dr. Henry A. Pilsbry has presented his conclusions on the climatic conditions and the effects on the molluscan fauna. (These Proceedings, 1935.)

Specimens collected from Anderson Basin were gathered from both the sandy eroded surface and an overlying medium light blue-gray clay remnant similar to the strata in which the mollusks of the Clovis Gravel Pit were collected.

The conditions at Anderson Basin in the past were undoubtedly extremely favorable, and possibly more so than at the Clovis Gravel Pit. Specimens collected from the Anderson Basin are of a larger size and a greater variety of species than those found at the Clovis Gravel Pit. These two features point to better environmental conditions.

Commonly found under debris of flood plains: *Gastrocopta armifera* (Say), *Retinella electrina* (Gld.), *Succinea avara* (Say), *Succinea grosvenori* (Lea), *Pupoides marginatus* (Say), and *Hawaiiia minuscula* (Binn.). Commonly found in inland lakes: *Helisoma anceps* (Mke.), *Helisoma trivolvis* (Say), *Lymnaea parva* Lea, *Lymnaea obrussa* Say, *Gyraulus parvus* (Say), and *Menetus exacuus* (Say). Commonly found in small streams with mud flats: *Physa gyrina* Say. Commonly found in wood pools: *Lymnaea palustris* Müll., *Lymnaea modicella* Say, and *Sphaerium striatinum* (Lam.). Commonly found in marshes and wet places: *Succinea retusa* Lea.

The two remaining sites from which mollusks were collected are of the typical basin formation which is so common throughout this region, the basin being formed mostly by wind excavation of the top soils down to the underlying bed stratum which in this case was a gray clay.

From this gray clay, which is similar to that of the Clovis Gravel Pit stratum from which mollusks were gathered, I collected the following species

from Eastern New Mexico State Park, most of which were weathered out from the gray clay. Commonly found in inland lakes, *Helisoma trivolvis* (Say). Commonly found in small streams with mud flats, *Physa gyrina* Say; commonly found in wood pools, *Lymnaea ohrussa* Say.

Species from one half mile south of the Clovis Gravel Pit road and three-quarters of a mile west of U.S. Highway 70. Commonly found under débris of flood plains, *Retinella electrina* (Gld.); commonly found in inland lakes, *Helisoma trivolvis* (Say); commonly found in wood pools, *Lymnaea palustris* (Müll.); commonly found in small streams with mud flats, *Physa gyrina* Say.

I wish to acknowledge the kind assistance of Dr. Henry A. Pilsbry in checking identifications of the above-mentioned species.

ON THE RELATIONSHIP OF THE NEARCTIC GENUS *DRACOTETTIX*
(ORTHOPTERA: ACRIDIDAE)

BY JAMES A. G. REHN.

In a recent paper Dr. B. P. Uvarov¹ has presented certain evidence which in his opinion demonstrates that the Californian, and Lower Californian, acridid genus *Dracotettix* of Bruner should be removed from the subfamily Cyrtacanthaeridinae (or Catantopinae as he prefers to call it), where it had previously been placed, to the Pamphaginae, a subfamily previously unrecognized in the New World.

In recent correspondence Dr. Uvarov has asked me to examine his conclusions and to let him know my impressions of the same. This I already have done at some length, and as a result of the constructive discussion which followed I am here presenting a consideration of the evidence brought forward by Dr. Uvarov, much of which has already been placed before him in correspondence or manuscript form. I may say that virtually all the conclusions here expressed have been discussed with and have the support, or at least the acquiescence, of my Philadelphia orthopterist colleagues, Messrs. Hebard, Roberts, and J. W. H. Rehn.

To prevent any possible misinterpretation I wish to state that, with my colleagues above-mentioned, I have no strong convictions as to the value or exact relationships of the groups of the Acrididae usually termed subfamilies. Certainly our present arrangement of them is hardly a natural one, but a more logical or natural disposition will require the comparative morphological study which has been so sadly lacking in the past. Dr. Uvarov deserves our thanks for the efforts he is making to determine the relative value and relationship of the subfamily or less important assemblages, in the course of which his observations on *Dracotettix* were made.

The genus *Dracotettix* was described by Bruner from a single species, *D. monstrosus*,² from "Los Angeles, Cal." Subsequently the same author added two species to the genus, *D. plutonius*³ from the Panamint Valley and Argus Mountains, California, and *D. californicus*,⁴ described from the Santa Cruz Mountains, Gilroy and Napa, California. In the same work in which the last-mentioned species appeared Bruner also described the related

¹ Pan-Pacific Entom., XIII, pp. 97-100, (July, 1937).

² Proc. U.S. Nat. Mus. XII, p. 51, pl. 1, fig. 1, (1889).

³ North Amer. Fauna, VII, p. 267, (1893).

⁴ Biol. Cent-Amer., Orth., II, p. 226, (1907).

genus *Litoscirtus*,⁵ based on a single Lower Californian species, *L. insularis*.⁶ In recent years Hebard added a fourth species of *Dracotettix* (*D. newboldi*) from Lower California.⁷ All of the five species concerned are represented in the Philadelphia collections, and by either the single types (3 species) or paratype material (2 species). The genus *Litoscirtus* was not before Uvarov when his comments were prepared and *Dracotettix newboldi*, the most primitive member of that genus, was similarly unavailable.

An analysis of Dr. Uvarov's comments shows that he based his arguments for the removal of *Dracotettix* to the Pamphaginae almost wholly on eleven points, which I shall discuss seriatim, presenting a quotation or summary of each from his paper, and following it with relevant discussion.

(1) Dr. Uvarov says his conclusions have been drawn from an "examination of a large number of genera of Pamphaginae". In correspondence since, he informs me he has studied twenty-five genera, being all known in the subfamily but four, represented by ninety species.

In this connection I have examined and compared with *Dracotettix* and *Litoscirtus*, material representing eighteen genera and forty species of Pamphaginae, in addition to a large amount of as yet undetermined African material of that subfamily. This count is exclusive of *Dracotettix* and *Litoscirtus*.

(2) The structure of the antennae in *Dracotettix* is said to exhibit "a tendency to a differentiation into ensiculus and flagellum of the more highly specialized Pamphaginae", although it is admitted that it is "not impossible for a member of Catantopinae".

The type of antennal structure seen in *D. monstrosus*, the single species examined by Uvarov, is not shared by all the forms of the genus, and in *D. newboldi* there is no definite differentiation of the proximal and distal portions of the same,⁸ while the considerable series of all the forms of the genus before me (over 160 specimens) shows the passage within that assemblage from one antennal extreme (the differentiated) to the opposite (simple) one. It should be recalled that not merely a few but a considerable number of genera of the Cyrtacanthaeridinae possess antennae of similarly differentiated type, as for instance a number of those making up the Neotropical Vilerinae, especially noticeable in *Clematodes*, *Osmiliola*, *Vilerna* and *Locheuma*, and well approached in quite a few other members of the same relatively cohesive group, in which we find a direct passage to a simple antennal structure. In addition in the more than a score of genera making

⁵ By a lapsus calami Uvarov referred to this genus as *Leptoscirtus*, which is the name of a well-known Old World oedipodid genus.

⁶ Biol. Cent.-Amer., Orth., II, p. 231, pl. 3, figs. 6, 6a, (1907).

⁷ Trans. Amer. Entom. Soc., LVII, p. 125, pl. XXII, figs. 5-7, (1931).

⁸ Hebard's figure of the female type of *newboldi* (Trans. Amer. Entom. Soc., LVII, pl. XXII, fig. 7) shows this correctly.

up what Brunner in 1893 termed the Tropidonoti (or more properly Tropinoti), a dominant Neotropical group most of the genera of which are before me, we find a variety of degrees of ensiformly specialized antennae, the exception in the group being a simple type. In *Litoscirtus* the antennae are actually somewhat thicker distad than they are in the proximal fourth. I might say in passing that the Nearctic acridid genus *Eritettix* exhibits within its limits a range of antennal form extending from simple to clavate.

(3) The "frontal ridge" in *Dracotettix* is said to be "of a type very characteristic for Pamphaginae, though similar structures of the ridge can be observed in certain genera of Catantopinae."

I interpret "frontal ridge" as meaning the frontal rostration and the connected frontal costa. The structure of this area as a whole in *Dracotettix* is no more conclusively indicative of affinity with the pamphagine genera than it is of relationship with the tropinotine *Procolpia* and *Prorhachis*, or the vileroid *Vilerna* and *Locheuma*. In the related *Litoscirtus*, however, the frontal rostration is almost non-existent.

(4) Uvarov considers "the structure of the fastigium of vertex proves beyond any doubt the Pamphagine affinity of *Dracotettix*," and specifically that "the fastigium is oval, strongly concave, with acute raised margins which tend to bifurcate near the eyes, although becoming less distinct posteriorly".

Unfortunately within *Dracotettix* the form of the fastigium passes from "oval" to acute-angulate cephalad (particularly in *D. newboldi*⁹ and also in the female of *D. plutonius*), the lateral margins ranging from acute to but faintly elevated carinae, while the discal surface may be strongly concave or but shallowly so. Granted that the fastigial form in certain *Dracotettix* does suggest the general structure seen in numerous pamphagids, that of *D. newboldi* shows clearly the line of affinity and development of the more extreme forms of the genus, and this feature, as present in the genus, can hardly be said to prove "beyond any doubt the Pamphagine affinity of *Dracotettix*."

(5) It is stated, "the bifurcated fastigial margins are amongst the essential characters of the subfamily Pamphaginae and the degree of their development in *Dracotettix* is exactly the same as in *Lamarckiana*, one of the most typical genera of that subfamily."

The bifurcation of these lateral margins, so strongly stressed by Uvarov, is entirely a secondary feature in *Dracotettix*, being weakly, but never strongly, indicated in the males and in some of the females of the Californian members of the genus, and in no way indicated in both sexes of *D. newboldi*,¹⁰ where even the slight traces of more lateral continuations of the

⁹ As shown by Hebard, Trans. Amer. Entom. Soc., LVII, pl. XXII, figs. 5 and 6.

¹⁰ Vide Hebard's figures of the vertices in that species. Trans. Amer. Entom. Soc., LVII, pl. XXII, figs. 5 and 6, (1931).

fastigial borders seen in *D. monstrosus*, are entirely absent. These margins are simple and undivided in *Litoscirtus*.

It should be noted, however, that the lateral fastigial borders are not invariably bifurcate in the Pamphaginae, *Tropidauchen* virtually lacking any division, and in the female of *Lamarckiana haploscelis*¹¹ they are definitely continuous laterad, the more caudal low carinulations bordering the fastigial impression being well separated and hardly a bifurcate continuation of the marginal structure.

(6) Uvarov considers "the general shape of the median carina (i.e. of pronotum) in *Dracotettix* is also very similar to that in *Akicera*".

This similarity is quite evident on comparison of material of the two genera, but equal resemblance in this respect is seen to the Neotropical cyrtacanthacrine genera *Cibotopteryx*, *Helionotus* and *Draconata*, all of which are before me. I feel this per se indicates no really intimate affinity, but rather parallelism in development of the pronotal crest, a feature which is remarkably plastic in the whole family. In *D. newboldi* the crest is much lower than in *D. monstrosus*, which in this respect shows the generic optimum, while in *Litoscirtus* the carina is low tectate and hardly at all cristate.

(7) Uvarov states, "The [prosternal] tubercle in *Dracotettix* is exactly of this type characteristic for Pamphaginae, since it is flattened in front and with the anterior edges formed by the prolongation of the anterior margin of prosternum, while its posterior surface is sloping and rugose. On this character alone, *Dracotettix* should be referred to Pamphaginae without any hesitation."

In the species of *Dracotettix* the form of the prosternal tubercle ranges from a triangular blunt pyramid, with its cephalic face and that of the prosternum as a whole uniformly concave (*monstrosus*), to an opposite extreme in which this has been strongly modified into a definitely compressed tubercle with its cephalic face, while continuous with the cephalic border of the prosternum, is obliquely bevelled (*newboldi*). In the male of *Litoscirtus* is found a structure similar to that of *D. newboldi*, in the female of that genus the tubercle is even more spiniform and slender.

As Uvarov has pointed out elsewhere the degree of development of the tubercle of the prosternum varies very markedly in the Cyrtacanthacridinae (or Catantopinae as he prefers to call it). Further, in the Pamphaginae there is not the uniformity of development of the tubercle "from the anterior margin of the prosternum" which Uvarov postulates. While the cephalic face of the tubercle, or the transverse ridge which may be its analogue, is continuous with that of the cephalic face of the prosternum, the

¹¹ Zomba, Nyassaland; 2000-3000 feet; September; 1♀; [Hebard Cln.]. Determined by Uvarov.

tubercle may, as in the Cyrtacanthacridinae, cover a full half of the prosternum with a broad range of striking and specialized development. Continuity with the prosternal margin, however, is not a peculiar feature of the Pamphaginae, cropping out as it does in numerous groups of the cyrtacanthacrids. In the Euthymiae alone, of the latter subfamily, we find almost as bewildering an array of prosternal variants in structural types as is seen in the Pamphaginae. Certain of these I have figured in a recently issued study of the Neotropical Euthymiae.

(8) The presence in *Dracotettix* of a "specialized (rugulose or striate) plate at the antero-inferior angle of the second abdominal tergite" is considered by Uvarov to be of outstanding value in placing the genus in the Pamphaginae, although as he admits it is absent in certain pamphagids and is also present in the Batrachotetriginæ. However, he believes these two groups are more closely allied than generally believed, so the presence of this feature in both is considered to be logical. In *Dracotettix* this plate is found in all the species, and it is also present in *Litoscirtus*.

In many genera of several subfamilies of Acrididae we find various stages of development of specialized areas laterad on the second abdominal tergite. They may be merely deeply punctate, irregularly rugulose or regularly striate, sharply defined as a special plate by a margining sulcus or not differentiated from the general tergal surface except by greater or lesser elevation. The condition discussed by Uvarov represents the maximum development of this feature. The majority of the forms which I have examined in which it occurs are geophilous types, and usually, but not invariably, inhabit semi-arid districts or are xerophiles in habitat.

In the Cyrtacanthacridinae will be found various degrees of specialized differentiation of the ventro-lateral portions of the second abdominal tergite in forms of *Eucoptacra*, in *Teratodes* (*T. monticollis*) and *Pycnosarcus*, and even the Palearctic *Pezotettix* (*P. giornæ* and *rugulosus*) shows indication of definition and striatulation of the surface of this area. However, in the Neotropical subfamily Ommexychinae we find delimited and specialized areas comparable to those found in many pamphagids present in the genera *Spathalium* and *Graca*, and indications are also present in the related genus *Ommexycha*. In the Pyrgomorphinae reduced but evident analogues are also seen in the African genus *Chirindites*, the Australian *Monistria* and the Malagasy *Rubellia*. In *Xyronotus*, a Mexican member of the same subfamily, a similar but differently arranged, yet strongly marked structure of the same type is present laterad on the third abdominal tergite. In the Pyrgomorphinae, as in the Pamphaginae, this development may be present or absent in genera of otherwise reasonably close relationship. Accordingly there seems to be a far less important phylogenetic significance to the presence of these specialized structures than one would draw from Uvarov's

argument. Their occurrence in clearly unrelated genera would point to parallelism in different groups, possibly as responses to habits of life and the role which stridulating ability plays in the life-history and survival of many, often flightless, acridids.

(9) Uvarov concludes, "The shape of posterior femur and the irregular disposition of the pinnate ridges on its externo-median area in *Dracotettix* are such as are usual for Pamphaginae, but not for Catantopinae" (Cyrtacanthaeridinae as used here).

The shape of the caudal femora in *Dracotettix* is certainly no indication of pamphagine affinity, in fact one of the important features for considering the genus of non-pamphagine affinity is associated with the femoral form. In all of the genera of the Pamphaginae which I have examined there is no true proximo-dorsal lobe or overhang of the caudal femora over its proximal articulation. In certain genera of the subfamily seen there is a slight socket indentation, but nothing approaching the type usual in the Cyrtacanthaeridinae. In most of the pamphagine genera, however, the articular surface at the base of the caudal femora is not covered or masked by a more dorsal definitely arcuate lobation, which is the condition found in certainly most, if not all, of the Cyrtacanthaeridinae, even genera such as *Taeniopoda*, which have slender and little expanded caudal femora. In this respect *Dracotettix* and *Litoscirtus* are similar and cyrtacanthaeroid. Dr. Uvarov, in correspondence, has called my attention to the fact that what I have here indicated as a pamphagine type of femoral base occurs also in the Batrachotetriginae and the Pyrgomorphinae. To my mind this merely strengthens the cyrtacanthaerine placement value of the other type as found in *Dracotettix* and *Litoscirtus*.

The paginal pattern can hardly be used as our index of relationship, as in the Pamphaginae alone we have a range from a subregular pinnate pattern to a definitely irregular type of carinal disposition. In *Dracotettix* we find some little range between the different forms in the degree of regularity of the pinnate pattern and also some individual variation, but no more irregularity in the general pattern than is found in many unquestioned cyrtacanthaerine genera or genera groups. In *Litoscirtus* the paginal pattern is much as in *Dracotettix*.

(10) Uvarov states definitely concerning *Dracotettix*; "The armature of posterior tibia is also as in Pamphaginae."

Lack of knowledge of all the forms of *Dracotettix* and of the genus *Litoscirtus* made this statement possible. In the Pamphaginae there is some little variation in the set and direction (in transverse section) of the marginal spines of these tibiae, but there is no marked tendency toward such a distinctive type as is found in the Neotropical Tropinoti of the Cyrtacanthaeridinae. In that group the internal tibial spines are very markedly

longer than the external series and in addition they are characteristically formed, their apices being extremely aciculate on a concavely conical base. Further the whole spine is usually in-bowed toward the median line of the tibia. This general condition is very definitely suggested in all the forms of *Dracotettix*, but most decidedly in *D. newboldi*, and in *Litoscirtus*. The in-bowing is always marked, but most striking in the latter genus. Very definitely as I see it, the armature of these limbs in all of the known species of the two genera involved, when taken collectively, is closer to what occurs in the group Tropinoti than the type present in the Pamphaginae.

(11) According to Uvarov, "the male abdomen of *Dracotettix* is recurved toward the apex which is compressed laterally, with the subgenital plate truncate and tuberculate, as in many Pamphaginae, but very unlike the various types of abdomen observed in Catantopinae."

These conclusions of Uvarov are evidently drawn from *D. monstrosus* alone, as in the four forms of the genus we find the ultimate sternite (subgenital plate) of the male ranges from "recurved" with the apex narrowly truncate tuberculate, and even bituberculate, to a blunt non-produced opposite extreme (*D. newboldi*) in which, while subcompressed, the sternite does not project caudad of the ultimate tergite (supra-anal plate). The genus *Litoscirtus* occupies, in this respect, a somewhat intermediate position between the extremes. Apparently Dr. Uvarov overlooked the fact that the ultimate sternite in males of the Tropinoti is definitely compressed, carinate and the apex, often markedly rostrate or recurved, develops essentially the same tendencies seen in the different forms of *Dracotettix*.

In this summary of Uvarov's points and comments relative thereto, it may be argued that a considerable number of the exceptions which I have taken to the features stressed by him as pamphagine are based quite largely on *Dracotettix newboldi*, and that this may be generically distinct from *D. monstrosus*, the genotype. To show that angle has been considered, I would say there can be no question of the generic cohesion of the forms referred to *Dracotettix*. They form a natural aggregation of which *newboldi* is clearly the most primitive and least specialized, and through it we can see the intimate affinity of the genus with *Litoscirtus*. Areally the forms of *Dracotettix* are localized and isolation has doubtless been a factor in the differentiation of the respective forms of the genus.

To sum up the preceding paragraphs I think it can be said that for no one of the eleven points advanced by Uvarov is the evidence unreservedly confirmatory of his contentions. In fact in most cases the discussion here presented definitely disproves their importance as indicative of pamphagine affinity in *Dracotettix*. In all cases I feel their value as such indicators is open to serious question.

Some of the arguments advanced by Uvarov would not have been suggested if there had been available to him a representation of the enormously varied Neotropical generic units equal to that of the pamphagid series at his disposal.

Supplementing discussion on the points advanced by Uvarov, I would call attention to the presence in all the members of the Pamphaginae which I have been able to examine, of a definite break cephalad in the fastigial margins, where the frontal costa passes dorsad without interruption into the scutellum of the fastigium, severing the margins which briefly laterad of this point are definitely carinate. In neither *Dracotettix* or *Litoscirtus* is such a break indicated, yet I have noted its presence to a greater or lesser degree in forty species of eighteen genera of the Pamphaginae. This feature was given by Saussure in his classic memoir on the group¹² as one of the distinguishing features of the latter subfamily. Dr. Uvarov, in correspondence, informs me that while this apical break is certainly a very conspicuous feature of the Pamphaginae, it is by no means an absolute character which would prevent the admission into the subfamily of any species without it. He says not only species, but adult individuals and young nymphs of the subfamily may lack it. I cite his statement as evidence contrary to my own experience, based as it is on his broader acquaintance with the Pamphaginae. However, I must take issue with the factual and logical elements of his further statement (in litt.) that "this is a feature which Pamphaginae shares with Tropinoti, and it is difficult to see how *Dracotettix* can be included in the latter group without possessing this character". I cannot do better than repeat the comment made on this in correspondence with Dr. Uvarov, to the effect that while I have seen and have available nearly all the genera of Tropinoti, in the group I do not know a case of a clear apical break in the fastigial margin such as one gets in Pamphaginae. While true fastigial marginal carinae in the Tropinoti (as first delimited by Brunner) may disappear cephalad in some species by obsolescence, this area is in no way fissate as in most pamphagids.

Summarized my conclusions are that *Dracotettix* and *Litoscirtus* are closely related, the generalized character of *D. newboldi* confirming their common ancestry. Any conclusions as to the position of *Dracotettix* must be equally pertinent to *Litoscirtus*. The reference of these two genera by most students to the Cyrtacanthaeridinae is in my opinion, from an analysis of the evidence pro and con, more logical and more definitely supported by fact than their placement in the Pamphaginae. They are evidently a xerothermic branch of the Tropinoti, a highly diversified stock of Neotropical origin, which constitutes one of the peripheral developments of the subfamily Cyrtacanthaeridinae, less divergent, however, than assumed by

¹² Spicilegia Entom. Genavensia, no. 2, p. 14, (1887).

Uvarov, as its line of contact can be detected in the varied, but in many respects less divergent, Neotropical *Vilernae*, which comprises more than a score of genera, and a xerothermic member of which (*Clematodes*) has also penetrated northward as far as the southwestern United States.

Whether the *Tropinoti* is a truly cohesive group, or is made up by more than a single stock, must remain for future study to determine.

As to the postulate advanced by Uvarov that *Dracotettix* is a relict genus of a much more widely spread xerothermic Pamphaginae, I feel the weight of really conclusive evidence is against it. For support it must depend on the survival power of such relicts during the Pleistocene, which period as a whole is generally considered to have been colder and more pluvial than at present. It is clear that the life of the warmer Pleistocene interglacials very largely succumbed, in such relatively northern latitudes, to the recurring periods of lower temperature. With these lower temperatures clearly went a definitely higher rainfall than is present in the same areas today, as attested by the evidence of lacustrine basins. Certainly desert and semi-desert conditions in our southwest have been progressively increasing, as affirmed by a wealth of evidence of many types, one of the most significant of which is the distribution of the land-snails of that region. In this connection the climatic index of the marine mollusks of the Californian Pleistocene deposits gives very definite evidence of the relative coldness of at least a portion of the Pleistocene in that district.¹³

The Rancho La Brea asphalt deposits may be pointed out as containing tropical, or at least subtropical, mammal types, but these were not necessarily xerothermic. All of these types of vertebrates have passed from the picture in southern California, just as the widely distributed Pleistocene tapirs, ground sloths, glyptodonts, saber-toothed cats, mastodons, non-Arctic mammoths and peccaries have from the eastern and southeastern United States, where they are to be found in many deposits of that age. The very diversity of the Rancho La Brea fauna prohibits the consideration of anything less than a fundamental control as the factor which devastated it. Temperature has the broad support of evidence from many directions. Whether *Dracotettix* is a survivor of a more ancient fauna, which has resisted temperature and pluvial changes, or is a more recent intrusion from the southward, remains to be determined, bound up as it is with a far more comprehensive problem.

Unfortunately in Dr. Uvarov's paper certain erroneous but inadvertent uses of geographic terms appear. In referring to *D. monstrosus* he states Bruner described it from "Lower California". Bruner did not mention

¹³ "Climatic Relations of the Tertiary and Quaternary Faunas of the California Region", by James Perrin Smith. Proc. Cal. Acad. Sci., (4) IX, no. 4, pp. 123-173, pl. 9, (1919).

Lower California, which, of course, is the English equivalent of Baja California, the official name of that political division of the Republic of Mexico, the species having been described from "Los Angeles, Cal.", meaning either the country or city of that name in the American State of California. In mentioning the genus *Litoscirtus* (called by inadvertence *Leptoscirtus*) Uvarov (p. 99) refers to it as "another Californian genus", although the original localities were "Central America" (probably in error) and Cerros (or Cedros) Island, off the coast of Lower California. Hebard has since recorded *Litoscirtus* from Lower California, but it is as yet unknown from California proper, although much intensive work has been done in that portion of the state adjacent to Lower California.

THE PHLOXES OF OREGON

BY EDGAR T. WHERRY.

For some years the writer has been collecting data on the genus *Phlox*, but so complex are the problems involved that there seems no hope of completing a monographic treatment in the near future. In order that certain taxonomic findings thus far made can be included in the Flora of Oregon which is under preparation by Professor Morton E. Peck, of Willamette University, the following notes on species and subspecies (designated by simple trinomials) known to occur in that state are being published. The plants are taken up in three groups, respectively those with tall erect stems and short styles; with like stems and long styles; and with short branched stems yielding caespitose clumps.

Erect-stemmed, Short-styled Group

Phlox speciosa Pursh.

The variant of this northern species on which the name was based, *P. speciosa cuspeciosa* Brand, is characterized by tall habit (average height 35 cm.), glabrate lower herbage, and thinnish long-acuminate leaves. It grows chiefly in Idaho and Washington, barely entering Oregon in the neighborhood of The Dalles. From eastern Washington southwestward it grades into a derivative with lower stature (average height 25 cm.) and slightly thickened, short-acuminate leaves, which has never received subspecies classification, so is here termed *P. speciosa occidentalis* (Durand) Wherry.¹ The absence of this from northern and central Oregon is apparently due to its having been destroyed there by Tertiary volcanic activity, for it is frequent in the southwest corner of this state, and southward into California.

Two variants of *Phlox speciosa* with thick, glandular leaves have developed in central Washington, and extend a short distance into Oregon. One may be known as *P. speciosa lanceolata* (E. Nelson) Wherry;² it averages 28 cm. tall, with long internodes, and few lanceolate leaves up to 30 to 60 mm. in length. The other was termed by E. Nelson *P. whitedii*, but Brand's name *P. speciosa lignosa* is the earliest in subspecies status. It differs in averaging but 20 cm. tall, the internodes being short and the leaves

¹ Status novus: *P. divaricata* var. *occidentalis* Durand, J. Acad. Nat. Sci. Phila. [2] 3: 97. 1855; *P. occidentalis* Durand ex Torrey, Rept. Expl. & Survey RR. 4: 125. 1857; *P. speciosa* . . . f. *occidentalis* Brand, in Engler's Pflanzenreich IV. 250: 74. 1907.

² Status novus: *P. lanceolata* E. Nelson, Rev. W. N. Am. Phlox: 29. 1899; *P. speciosa* . . . f. *lanceolata* Brand, in Engler's Pflanzenreich IV. 250: 73. 1907.

numerous, linear to lanceolate, and up to 15 or exceptionally 30 mm. long. Material from Tygh Valley, Oregon, is gradational between these, but typical specimens of the second were distributed from the state's "eastern prairies" by Howell.

Another variation from the ancestral *P. speciosa* stock consists in loss of pubescence from the entire plant except the inner surfaces of sepals, resulting in *P. speciosa nitida* (Suksdorf) Wherry,³ in southern Washington. This migrated southward into California, but as was the case with its immediate ancestor, *P. s. occidentalis*, it vanished from northern and central Oregon, and survives in this state only toward the southwest corner.

Phlox colubrina Wherry and Constance.

While similar to *P. speciosa nitida* in the limitation of pubescence to inner sepal-surfaces, this *Phlox* has leaves averaging only 1.5 mm. wide (as against 4 mm. in most subspecies of *P. speciosa*); moreover its corolla-lobes are unique in the group in being elongate and acutish to mucronate, those of *P. speciosa* being normally short, obtuse, and notched. It has accordingly been described recently as a new species.⁴ It is endemic in Idaho and Oregon along the Snake River canyon, in the latter state also extending well up into the northeastern mountains.

Erect-stemmed, Long-styled Group

Phlox adsurgens Torrey ex Gray.

The type locality of this species was Canyon Pass, south of Canyonville, Douglas County, Oregon. A visit there in 1931 showed it to be abundant as a ground-cover in thin woodland, the diagnostic character given for it by Brand, "stolons lacking," being erroneous. It is closely related to the eastern *P. stolonifera* Sims, which also has well-developed creeping stems with broad leaves, the two having no doubt arisen from a common ancestor which grew in the far north in pre-Glacial times. Northern occurrences were destroyed, however, by the ice, and the limiting station at present known is 8 miles south of McKenzie Bridge, Lane County, Oregon.

Phlox viscida E. Nelson.

Diagnostic features of this *Phlox* comprise the presence of glandular pubescence nearly throughout the herbage, and flat intercostal membranes of the calyx. Brand associated it with *P. stansburyi*, but it differs markedly from that southern species. It is endemic in the mountains of southeastern Washington and adjacent Oregon.

³ Status novus: *P. speciosa* var. *nitida* Suksdorf, Deutsch. botan. Monatsb. 18: 32. 1900; *P. speciosa* . . . subvar. *nitida* Brand, in Engler's Pflanzenreich IV. 250: 74. 1907.

⁴ Amer. Midl. Nat. 19: 433. 1938.

Phlox longifolia Nuttall.

This widespread northern *Phlox* is characterized by the presence of conspicuous bulges in the intercostal membranes of the calyx, often termed replications, but more aptly described as carinae. Several of its variants have been classed as independent species, and the fact that they sometimes occur in pure stands lends some support to this procedure. In numerous colonies, however, two or more occur so intermingled that they can only be regarded as extremes in a variable series, so subspecific status is here assigned to five of them.

A variant ranging from moderately dwarf to tall and slender, with the upper herbage densely glandular-pubescent and the largest leaves around 50 to 100 mm. long is regarded as the ancestral one. Recombining the earliest name assigned to it leads to its being termed *P. longifolia longipes* (Jones) Wherry.⁵ From this arose a usually dwarfer and consistently short-leaved extreme—maximum fertile-stem leaf-length 25 to 45 mm.,—which may be known as *P. longifolia compacta* (Brand) Wherry;⁶ this has been supposed to have the calyx membranes only obscurely carinate, but the type specimen does not bear this out. At the type locality this grows intimately admixed with two or three other subspecies, all blooming simultaneously.

Another direction in which variation occurs is in the nature of the pubescence; this may remain abundant, but become wholly eglandular, without change in the plant's stature or leaf-length. Such was the variant on which the original species description was based; it was also represented in Hooker's *P. speciosa* var. *linearifolia*, and Brand named it *P. longifolia linearifolia*, which is here adopted. As in the glandular material, another variant has on the average lower stature and shorter leaves; this was first collected by Douglas, and may be known as *P. longifolia humilis* (Douglas ex Hooker) Wherry.⁷ Finally, the pubescence may tend to thin out, ultimately yielding plants which are wholly glabrous except within the sepals. St. John⁸ has recently regarded this as the original *P. longifolia*, overlooking Nuttall's use of the term *puberuli* in characterizing that species. The glabrous subspecies has never been assigned a name, so may be known as:

⁵ Status et comb. nova: *P. linearifolia* var. *longipes* Jones, Contr. W. Botany 12: 53. 1908; *P. longifolia* var. *filifolia* A. Nelson, Bot. Gaz. 54: 143. 1912.

⁶ Comb. nova: *P. virida* E. Nelson, Rev. W. N. Am. Phlox: 24. 1899; *P. longifolia* var. *puberula* ibid. 26; *P. stansburyi compacta* Brand, in Engler's Pflanzenreich IV. 250: 67. 1907; *P. puberula* A. Nelson, in Coulter's Man. Bot. C. Rocky Mts.: 397. 1909.

⁷ Status novus: *P. humilis* Douglas ex Hooker, Flora Bor.-Amer. 2: 72. 1838; *P. speciosa* β Hooker, loc. cit.; *P. longifolia* . . . var. *humilis* Brand, in Engler's Pflanzenreich IV. 250: 66. 1907; *P. cernua* E. Nelson, Rev. W. N. Am. Phlox: 22. 1899.

⁸ Torreya 36: 94. 1936.

Phlox longifolia calva Wherry, subsp. nova.

Differing from all other variants of the species in having the herbage wholly glabrous, except inside the sepals. Plant 10 to 50 cm. tall; largest leaves 45 to 90 mm. long and 2 to 4 mm. wide. Text-fig. 1.



Fig. 1. *Phlox longifolia calva*, subsp. nova. Habitat view of the plant selected as the type.

Planta tota glabra, sepalis interne exceptis, 10 ad 50 cm. alta; folia maxima 45 ad 90 mm. longa et 2 ad 4 mm. lata.

Type collected by Edgar T. Wherry June 21, 1931, 13 miles southwest of Darlington, Custer County, Idaho, in herbarium Academy Natural Sciences Philadelphia. Range, central Washington to western Montana, south to Utah and Colorado. May occur mingled with one or more of the other representatives of the species, but locally forms pure stands.

All five subspecies here recognized occur scattered over northeastern Oregon, as far west as Mono, Shaniko, and Tygh Valley. Many colonies include two or more of them, with intermediates between extremes.

Cespitose Group

Phlox douglasii Hooker.

Phototype and clastotype material of this northern *Phlox* in American herbaria shows it to be an open-cespitose plant averaging 15 cm. high, with the herbage abundantly beset with long septate gland-tipped hairs. Un-

familiar with its features, E. Nelson applied to an unusually large but otherwise typical specimen of it the name *P. piperi*. It occurs chiefly in the Columbia Plateau region of eastern Washington and Oregon, with an alpine extreme in the Cascades. Reports from other regions are based on what are here regarded as wholly distinct species.

The subspecies on which the name *douglasii* was based has been named by Brand ssp. *eudouglasii*; its type locality was the Blue Mountains. In bleak or dry places this grades into a plant differing chiefly in being lower in stature—average height 5 cm.—which has stiffish leaves and was named by Bentham *P. rigida*. Gray referred this to a variety of the Rocky Mountain *P. caespitosa*, but the glandularity of its leaves leads to its reclassification here as *P. douglasii* **rigida** (Bentham) Wherry.⁹ This occurs in several places in the Columbia Plateau.

Above tree-line in the Cascades further evolution occurs; the leaves become more appressed and somewhat shorter (average maximum length 7.5 mm.) and the styles have an average length of but 2.5 mm. This is the plant termed by E. Nelson *P. condensata* var. *hendersoni*. Its resemblance to *P. condensata* may well be due merely to their occupying similar high-alpine situations, and in pubescence it is more like the *P. douglasii* series. Did it not intergrade with ssp. *rigida* it might be assigned species status, but it is more safely classed as *P. douglasii* **hendersoni** (E. Nelson) Wherry.¹⁰

From the Phloxes just discussed *P. caespitosa* Nuttall differs in having the glandularity limited to the inflorescence. Its various subspecies occur largely in the Rocky Mountains, but it may possibly enter eastern Oregon locally.

Phlox covillei E. Nelson.

This species differs from the others in the Great Basin region in having tiny thickish leaves of elliptic-lanceolate outline, only 3 to 5 times as long as wide. Its herbage is pubescent, but only a portion of the hairs are gland-tipped. It has been known heretofore from California and Nevada, but Professor Peck has collected what appears to be a variant of it above Ice Lake in the Wallowa Mountains of Oregon.

Phlox lanata Piper.

The type locality of this northern *Phlox* was Steins Mountain, Harney County, Oregon; it is now known to extend also into Montana. It is pulvinate in habit, with long prostrate leafy shoots. The herbage, except toward the tips of leaves and sepals, is covered by copious tomentose hairs, and even the corolla-limb may bear minute pubescence.

⁹ Status novus: *P. rigida* Bentham, in DC. Prodrômus 9: 306. 1845; *P. caespitosa* var. *rigida* Gray, Proc. Amer. Acad. Arts Sci. 8: 254. 1870.

¹⁰ Status et comb. nova: *P. condensata* var. *hendersoni* E. Nelson Rev. W. N. Am. Phlox: 14. 1899; *P. caespitosa* . . . var. *hendersonii* Brand, in Engler's Pflanzenreich IV. 250: 84. 1907.

Phlox diffusa Benth.

In describing this northern *Phlox* from near the southern end of its range in California in 1849, Bentham suggested it to be related to *P. douglasii*, but the characters he gave to distinguish them were not well chosen, no reference to their difference in pubescence being made. Gray proceeded to reduce *diffusa* to varietal status, and has been followed by many subsequent workers, leading to great confusion. Phototypes and elastotypes of *P. diffusa* show it to be a spreading plant, pubescent with long wholly eglandular hairs; its leaves are thinnish, linear but not sharp-pointed, and



Fig. 2. *Phlox diffusa longistylis*, subsp. nova. Habitat view of the colony from which the type specimen was selected.

reach a length of 15 mm. In the upstanding *P. douglasii*, on the other hand, the hairs are gland-tipped, and the leaves are thickish, subulate with a sharp point, and rarely as much as 10 mm. long. If any division of the caespitose *Phloxes* (which Gray considered "almost inextricable") is to be made at all, species differentiation has to be based on characters such as these. *P. douglasii* and *P. diffusa* are accordingly here maintained as independent.

Phlox diffusa is common from the hills of western British Columbia southward along the Cascades to the Sierras of California, where it is limited

to fairly high altitudes. Toward the northern end of this range its styles are 6 to 12 mm., toward the south 3 to 5 (rarely 7) mm. long, the boundary between the two variants lying in northern Oregon. The southern one was the original *P. diffusa*, and may accordingly be named *P. diffusa typica* Wherry.¹¹ Nearly all specimens seen from western Oregon belong here. The northern extreme deserves a subspecies name, as follows:

P. diffusa longistylis Wherry, subsp. nova.

Differing from ssp. *typica* in somewhat lower stature and smaller leaves and flowers, and especially in having longer styles, 6 to 12 mm. in length. Text-fig. 2.

A subspecies *typica* differt planta paulo minor et stylis 6 ad 12 mm. longis.

Type collected by the writer July 30, 1931, at 7250 feet altitude on the south slope of Mt. Adams, Yakima County, Washington, in herbarium Academy Natural Sciences Philadelphia. Range, British Columbia south to House Mountain, Marion County, Oregon.¹²

Phlox hoodii Richardson.

While this species was described from the plains of Saskatchewan, and is especially frequent in the high plains and eastern foothills of the Rockies, it also crosses these mountains in Idaho and spreads over the Great Basin region. The phase most developed in the latter area differs from the original in having a slightly longer corolla-tube, and was named *P. canescens* by Torrey and Gray. The differences between them are so slight and the intergradation so complete, however, that only subspecific independence seems justified, leading to the new combination: *P. hoodii canescens* (T. & G.) Wherry.¹³ This subspecies occurs sporadically in the Columbia Plateau region of Oregon, extending up to the eastern foothills of the Cascades. It thus approaches the range of *P. diffusa*, from which it differs in its more compact habit, and smaller leaves and flowers.

Phlox austromontana Coville.

While originally described from southern Utah, this *Phlox* with its distinctive acerose leaves and carinate calyx-membranes is wide-ranging over the Great Basin and adjoining physiographic provinces. In Oregon it has been collected as far north as Union County. A long-styled phase of it

¹¹ Nomen novum: *P. diffusa* Benth. Plant. Hartweg.: 325. 1849; *P. douglasii* var. *diffusa* Gray, Proc. Amer. Acad. Arts Sci. 8: 254. 1870.

¹² When I first encountered this *Phlox* and observed its differences from the original *P. diffusa*, I supposed it might prove to be *P. caespitosa* Nuttall, and so reported to St. John and Warren, who have included it under that name in "The Plants of Mt. Rainier National Park, Washington", Amer. Midl. Nat. 18: 978. 1937. Actually the Mt. Rainier *Phlox* is this newly described *P. diffusa longistylis*.

¹³ Status novus: *P. canescens* Torrey & Gray, Rept. Bot. RR., Mo. Pac. 41°, 2: 122. 1855.

was described by Brand as *P. densa*, but this is scarcely separable; his *P. pinifolia*, so far as can be ascertained, is another minor variant of the same species.

***Phlox peckii* Wherry, sp. nov.**

Plant a prostrate under-shrub; main root branching above into several creeping woody stems, sending up erect branches 1 to 3 cm. tall, yielding pulvinate-cespitose clumps; internodes short, their surface laminated, more or less pubescent; leaves spreading, thinnish, linear, 4 to 8 mm. long and 0.5 to 1.5 mm. wide (ratio of length to width 5 to 10), basally densely ciliate with septate hairs, superficially granulate to glabrous; the tip bearing a short cusp; inflorescence 1-flowered, the pedicel 1 mm. long, quadrate; sepals 8 mm. long, united about $\frac{1}{2}$ their length, the costa prominent, awn-tipped; intercostal membranes distinctly carinate; pubescent with long kinky septate eglandular hairs, on the outside near the base and on the inside of the lobes toward the tip; corolla-tube about 12 mm. long, somewhat dilated upward; lobes cuneate, 5 mm. long and 2.5 mm. wide, terminally erose-mucronulate, their upper surface beset to a distance of 3 mm. from the orifice with fine kinky septate hairs up to 0.5 mm. long; upper part of tube yellowish, limb cream-color; stamens extending rather high up the tube, one or two anthers slightly exserted; styles 4.5 mm. long, united to $\frac{1}{2}$ their length, the 3 stigmas thus 1 mm. long; ovules solitary. Text-fig. 3.



Fig. 3. *Phlox peckii*, species nova. Flower $\times 2$, showing unique pubescence.

Fruticulus prostratus; folia linearia, ad 8 mm. longa et 1.5 mm. lata; calycis membranæ carinatae, tubo baso eglanduloso-pubescente; corollae lobi superne pubescentes, pilis ad 0.5 mm. longis; styli 4.5 mm. longi, ad $\frac{1}{2}$ longitudinis conjuncti.

Type collected by Professor Morton E. Peck of Willamette University, Salem, Oregon, in whose honor the plant is named: No. 19302, July 14, 1936, dry slope, north rim of Crater Lake, Oregon. Type in Herbarium Academy Natural Sciences Philadelphia.

This *Phlox* is obviously a derivative of *P. diffusa*, in which the flat to wrinkly calyx-membrane of the parent species has become rather definitely carinate (as it has in *P. austromontana* also). In most *Phloxes* the corolla limb is glabrous, but in a few of the cespitose ones it is minutely granulate, and in *P. lanata* occasionally fine-puberulent. The present species, however, is the only one known in which the corolla-limb is definitely pubescent.

Of the 12 species discussed in the above pages, 6 are northern in geographic relationship, being best developed in the northern Rocky Mountains, and enter Oregon from the northeast; 3 are southern, ranging over the Great Basin, and occupying southeastern Oregon; while the remaining 3 are endemic in Oregon, or in this state and adjacent portions of surrounding ones.

DESCRIPTION OF *HETEROMYS DESMARESTIANUS* *CHIRIQUENSIS*

BY ROBERT K. ENDERS,

Swarthmore College.

Among the mammals collected by the writer and Mr. A. J. Drexel Paul, Jr., in 1935, while on an expedition of the Academy of Natural Sciences of Philadelphia, is an undescribed subspecies of the genus *Heteromys*. It was then considered unwise to describe a new subspecies based upon three specimens, so publication was postponed. Subsequent work by the Academy and Swarthmore College, aided by a grant from the American Philosophical Society, has added considerably to our knowledge of this new subspecies.

Heteromys desmarestianus chiriquensis new subspecies.

Type: An adult male, skin and skull, A.N.S.P. No. 17835, collected by Robert K. Enders, August 20, 1935, between Rio Chiriquí Viejo and its tributary Rio Colorado on a hill known locally as Cerro Pando, at an elevation of 4,000 feet, about ten miles from the post office of El Volcán, Province de Chiriquí, R. de Panama. Original No. 1165.

Distribution: Known from western Panama between Rio Chiriquí Viejo and the continental divide, in the valleys of Rio Colorado, Rio Cotito, Rio Santa Clara, and Rio Chebo.

General characters: Resembles *Heteromys desmarestianus desmarestianus* and *H. d. fuscatus* more than *H. d. repens* from El Volcán de Chiriquí. General coloration darker, less ochraceous, lateral line more distinct than in *H. d. desmarestianus*; ankles dark all around with black extending to heel, ears black with no white tips or fringe; size larger, tail somewhat shorter; maxilla and premaxilla heavier posterior, at, and anterior to anterior palatine foramen; brain case narrower with appearance of being more constricted. Differs from *H. d. planifrons* of western Costa Rica in having a more distinct tawny lateral line on flanks; the tail considerably darker both above and below and somewhat shorter; ankles dark all around in most specimens with the black hair extending to the heel while in *H. d. planifrons* a white line extends to the dorsum of foot; skull apparently narrower, brain case not expanded, tympanic bullae conspicuously smaller, premaxilla ending posterior of nasals; temporal fossa longer turning dorsad posteriorly. Differs from *H. d. subaffinis* in being much darker; skull narrower, longer, more drawn out, lighter; premaxilla exceed nasals more than in *H. d. subaffinis*, temporal fossa narrower, longer, and deeper. Larger and darker

than *H. d. repens*, with distinct buffy lateral line which is lacking in *H. d. repens*, nasals end anterior to premaxilla, not posterior as in *repens*, ankles dark all around.

Color of type: Upper parts mixed; spines blackish, hair dark grey at base, tipped with orange buff, sides lighter, more buffy; lateral line buff orange; under parts white, except scrotum, buffy in inguinal region; suggestion of light line down inner side of hind leg; ankles dark all around, tail brownish black above, lighter below.

Skull: Long, with relatively narrow brain case and narrow frontals and parietals; temporal fossa narrow, deep, long, posterior portion bending dorsad.

Measurements: Total length 302 mm., tail vertebrae 154, hind foot 35, ear 19. Skull: Greatest length 37.6 mm., zygomatic breadth 17.2, inter-orbital breadth 10.1, length of nasals 17. A female topotype: 285; 151; 37; 18.

Remarks: *Heteromys desmarestianus chiriquensis* is a clearly defined subspecies apparently more closely approaching other subspecies than its nearest geographic neighbor *H. d. repens* of El Volcán de Chiriquí. The altitudinal range in which it was taken is rather narrow, 3800 to 5200. Apparently the subspecies has differentiated between the Chiriquí Viejo and the continental divide for it was not taken on the opposite bank.

Specimens examined: Total number 35, all from the region mentioned above as follows: Cerro Pando 18, Cotito Hot Springs 6, Santa Clara 5, Osta Clara 5, Rio Chebo 1.

A SMALL COLLECTION OF FRESH-WATER FISHES FROM EASTERN CUBA

BY HENRY W. FOWLER.

Curator of Fishes, Academy of Natural Sciences of Philadelphia

Dr. Charles T. Ramsden, a Correspondent of the Academy, recently forwarded the forty-one fishes, from eastern Cuba, determined in this paper. The collection is a characteristic representation of the fresh-water fish fauna of eastern Cuba, and the Academy is therefore indebted to Dr. Ramsden for this valuable gift. An interesting cichlid is here described as a new species, apparently having long been confused by its vernacular name "Joturo". Dr. Ramsden's comments follow:

"Poey in his *Memorias* II, pp. 263, tab. 18, figs. 4 and 5, 1856-58, describes the *Joturus*, and the species *pichardi*, which is a mugilid. He chooses for the common name that of 'Joturo' used by Desiderio Herrera, Tranquilino Sandalio, de Noda, and Esteban Pichardo to that of 'Fortuo' used by the Havanese. Guantánamo is famous for its 'Joturos' found only, so far as I know, in its rivers and their tributaries. The Guaso River flows through Guantánamo city, coming from the hills to the north. There is a saying that 'He who eats Joturo, and bathes in the Guaso River never leaves Guantánamo.' The fish by that local name is well known not only at Guantánamo, but most everywhere through the island of Cuba where Guantánamo is spoken of. It is not rare, neither is it common, and is being driven out of existence by the more quarrelsome 'Biajaca' (*Cichlasoma tetracanthus*), so that in the not distant future may disappear altogether. This danger is much greater since the Secretaria de Agricultura [in August] have planted several Florida large mouth bass in these rivers, if one is to judge by the results of the same thing in one of the artificial lakes about the Country Club at Havana where a similar planting was made some years back. Here the bass destroyed all the native fish even to the *Gambusias* and *Limias* so that mosquitos increased, became a menace and the lake was drained in order to take out the bass and replace native species.

"The 'Joturo' is certainly a cichlid, and not a mugilid. The specimen sent is a typical adult, now getting scarce to find full grown. It cannot be mistaken even at first sight for *C. tetracanthus*, on account of its contour and its predorsal hump, and is splendid eating. Its nature is more mild, and though cichlid-like in its behaviour, making holes or depressions in the sand at the bottom of aquariums and attacking most other fish, it is nevertheless much more mild in disposition. It is not known outside the Guantánamo river system and tributaries. *C. tetracanthus* is found also

in these streams, but 'Joturo' never goes near brackish water, while *C. tetracanthus* does. There is one exception and that is the Bayate River which I am told flows north, and there are to be found the 'Joturo' and none of *C. tetracanthus*. This I have not been able to prove to my satisfaction and take it on its face value as native information, but even so Bayate is considered as of the Guantánamo area and certainly belongs politically to the Guantánamo Municipality and its Judicial District."

POECILIIDAE

Gambusia punctata Poey. "Guajacón."

Three examples, 53 to 59 mm., streams in environs of Santiago de Cuba. Females. 1937.

Limia vittata (Guichenot).

Three, 80 to 82 mm., streams in environs of Santiago de Cuba. Females. May 1938.

MUGILIDAE

Agonostomus monticola (Griffith). "Dajao."

Eight, 131 to 168 mm., old aqueduct at Santiago de Cuba, April 1938. Also two, 100 to 124 mm., same locality, in January 1938. Also four, 43 to 54 mm., at Rio Camino at County Club, Santo Domingo, December 1937, besides two others 44 and 47 mm. without date of capture.

The young are interesting in proportions, showing the eye greatly exceeding the short snout and A. II, 10, 1. They also show the scale rows converging and with smaller scales on caudal peduncle than on trunk. In coloration they have a dark brown streak from the snout tip through the eye and back over opercle to dark brown spot at pectoral base. Another larger one at middle of caudal base. Some specimens show a more or less complete dark lateral axial band, though this is usually broken into variable brown spots. First dorsal with dark brown basally, apically white. Second dorsal often with dark brown anterior basal blotch, median basal bar and terminally fin gray. Caudal other than dark basal blotch white, gray terminally on lobes. Other fins whitish.

In the series of larger examples all show the scales of the back with a dark reticulated pattern, due to the darker scale borders. Lower $\frac{3}{5}$ of body bright silvery white. Markings on fins all quite variable though more or less contrasted. Usually first dorsal spines blackish brown, and each membrane whitish with variable blackish brown blotch between each spine. Second dorsal and anal largely grayish terminally, sometimes even gray black, likewise caudal, though latter always with whitish base. Some specimens show scattered or indistinct brown spots on flanks, variable or irregular. Paired fins usually with terminal gray area or blotch.

CICHLIDAE

Cichlasoma tetracanthus (Valenciennes). "Biajaca, Bijaca."

One, 163 mm., Guaso River, Guantánamo, December 1937.

One, 143 mm., Guaso River, December 1938.

Cichlasoma ramsdeni new species. "Joturo."

Depth $2\frac{1}{5}$ to $2\frac{3}{5}$; head 3 to $3\frac{1}{5}$, width $1\frac{1}{5}$ to $2\frac{1}{5}$. Snout $2\frac{1}{10}$ to $2\frac{1}{2}$ in head; eye $3\frac{1}{4}$ to $5\frac{1}{4}$, $2\frac{1}{3}$ to $2\frac{2}{3}$ in snout, 1 to $1\frac{1}{2}$ in interorbital; maxillary reaches $\frac{1}{2}$ to $\frac{3}{4}$ in snout, length $3\frac{1}{8}$ to $3\frac{1}{2}$ in head; lips broad, smooth, fleshy; teeth in villiform bands in jaws, close set and fine, outer row well enlarged, especially in front, simple, conic and with dark brown tips, thus greatly contrasted with otherwise pale color of teeth and lips; palate and tongue edentulous; interorbital $3\frac{1}{2}$ to $3\frac{3}{8}$ in head, broadly convex. Preopercle edge entire. Gill rakers $3 + 10$, short, robust, points $\frac{1}{3}$ to $\frac{1}{4}$ of gill filaments, which $1\frac{1}{2}$ in eye.

Scales 19 in upper section of lateral line; 11 or 12 + 2 in lower section; 7 scales between origin of spinous dorsal and upper section of lateral line; 5 or 6 scales above upper section of lateral line and posterior dorsal spines, of which 2 or 3 may form in basal scaly sheath; 11 scales below lower section of lateral line and anal origin. Ventral without pointed axillary scale. Bases of dorsals and anals only moderately scaly, though with scales all much smaller than adjacent body scales. Characteristic is the compressed elevated predorsal hump, evident in all except the smallest specimen and completely covered with scales, the predorsal scales 12 to 14 and extending forward until opposite front part or edge of eye. Snout and most all of muzzle, including preorbital, naked. Cheek with 4 or 5 rows of comparatively large scales, leaving preopercle flange naked. Opercle and postocular scaly. Scales much smaller on chest and breast than elsewhere on body, except caudal base, where scaly area invades $\frac{2}{3}$ basal part of fin. Scales in lateral line with simple tubes, well exposed, and each tube to hind edge of scale exposure. Scales with 12 basal radiating striae; 80 to 85 small apical denticles, with 16 or 17 transverse series of basal elements; circuli very fine.

D. XV, 12, 1 to 13, 1, last spine $1\frac{1}{2}$ to 2 in head, seventh ray $2\frac{1}{3}$ to $2\frac{3}{4}$ in fish without caudal; A. V, 9 1 or 10, 1, fifth spine $1\frac{1}{2}$ to $2\frac{1}{3}$ in head, third or fourth ray $2\frac{1}{3}$ to $2\frac{3}{4}$ in fish without caudal; caudal 1 to $1\frac{1}{2}$ times head, convex behind; least depth of caudal peduncle $2\frac{1}{3}$ to $2\frac{2}{3}$ in head; pectoral $1\frac{1}{3}$ to $1\frac{1}{2}$, rays 1, 13; ventral rays I, 5, fin equals head.

Color when fresh in alcohol variably with pale appearance, largely pale appearance, largely pale or light brown, under surfaces of head and abdomen whitish. Many scales on sides medially with darker brown spot, blackish brown in largest example. Last also with back, lower sides of head, flanks, spinous dorsal and front of soft dorsal largely vinaceous-cinnamon; front of head and predorsal crest, muzzle, tail posteriorly or area inclusive of straight section of lateral line, lower edge of belly, greater posterior parts of soft dorsal and anal, and all of caudal olive buff. Usually vertical and ventral fins variably dark neutral or gray brown to blackish, and pectorals whitish.

Type, A.N.S.P. No. 68454. Arroyo Hondo, Jamaica, Yateras, Guantánamo, Cuba. December 1937. Dr. C. T. Ramsden. Length 243 mm.

Also paratypes, A.N.S.P. Nos. 68455 to 68458. Guaso River, Guantánamo, Cuba. Length 123 to 178 mm.

Besides the paratypes a still smaller specimen 119 mm. from the Guaso River at Confluente, Guantánamo. Taken when 13 mm. long, aquarium fish. 1936.

This species is related to *Cichlasoma tetracanthus* (Valenciennes), though is quite distinct in structure, general facies as well as coloration. It differs at once in the greatly larger scales on the cheek in 4 rows, in 6 to 8 rows in *C. tetracanthus* and its various subspecies. The deep body contour, the elongated, pointed, filamentous soft dorsal and anal and greatly deeper preorbital, are other characters.

For comparison the two specimens of *C. tetracanthus* from Guantánamo also bear out these contentions, the larger of which is somewhat suggestive of Eigenmann's *Heros nigricans* and the smaller more like his figure 12 of *Heros tetracanthus tetracanthus*.

Both of Dr. Ramsden's specimens are, however, far more ornate and contrasted, the spots, bars, blotches and bands very distinct.

(For Dr. Charles T. Ramsden.)

ELEOTRIDAE

Dormitator maculatus (Bloch). "Conguito."

Two, 114 to 130 mm., in fresh water of streams at Guantánamo and Santiago.

Eleotris pisonis (Gmelin). "Conguito."

Three, 120 to 140 mm., in fresh and brackish water of stream about Santiago and Guantánamo.

Gobiomorus dormitor Lacepède. "Guavina."

One, 241 mm., Rio Guantánamo, May 5, 1938.

GOBIIDAE

Gobius lyricus Girard.

Gobius lyricus Girard, Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 169 (type locality, Brazos Santiago, Texas); Rep. U.S. Mex. Bound Surv., Ichth., p. 25, pl. 12, figs. 4-5, 1859.

Depth $4\frac{3}{4}$; head $3\frac{1}{2}$, width $1\frac{1}{2}$. Snout $3\frac{1}{2}$ in head; eye $4\frac{1}{2}$, $1\frac{1}{2}$ in snout, greater than interorbital; maxillary reaches opposite front eye edge, in profile length $2\frac{3}{4}$ in head; jaws equal; lips narrow, thin; teeth minute, simple, compressed, close set, pointed, pair within at symphysis, slightly enlarged. Tongue broad, rounded, free. Interorbital narrow, width $1\frac{1}{2}$ in eye; preorbital depth $\frac{2}{3}$ of eye. Gill rakers minute or rudimentary, not made out. Gill filaments $1\frac{1}{2}$ in eye.

Scales $30+3$ in axial lateral series; 11 transversely between second dorsal and anal origins; 16 predorsal forward nearly midway in interorbital space. Except front of head, preorbital, jaws and opercles below, head

scaly. Chest, breast and belly with small scales. Five rows of minute papillae down from lower eye edge, intersected by transverse or horizontal row medially; line also close along and behind vertical hind edge of preopercle. Outer pectoral base with small scales.

D. VI, I, 10, 1, second, third and fourth spines ending in filaments when depressed reach $\frac{2}{3}$ in base of second dorsal, first branched ray $1\frac{1}{2}$ in head; A. I, 11, 1, first branched ray $2\frac{2}{5}$, tenth $1\frac{2}{5}$; caudal $3\frac{1}{2}$ in rest of fish, median rays longest and fin rounded behind; least depth of caudal peduncle $2\frac{1}{8}$ in head; pectoral rays 1, 14, none detached; ventral rays I, 5, fin $1\frac{1}{4}$ in head. Anal papilla $1\frac{3}{4}$ in eye, globose.

Color very pale brown, whitish on under surface of head and belly. Back with 6 very faint, though darker brown saddles, alternating on sides with obscured grayish blotches, and on caudal base an upper larger darker brown blotch and below fainter one. Dorsals grayish, with white spots, more or less arranged in streaks and rows, and some on first fin with variable still dark spots in grayish areas. Anal grayish, with broad white border. Caudal gray, with transverse series of small white spots medially and basally on fin. Paired fins pale gray, with whitish spot at base externally.

Length 81 mm.

This interesting specimen was in Dr. Ramsden's collection from Guanátamo. As it does not appear to be abundant, though reported from Porto Rico, I have given the above description.

Awaous taiasica (Lichtenstein). "Sirajo."

Four, 143 to 300 mm., Rio del Acueducto, San Boniato, Santiago de Cuba, May 20, 1938.

DESCRIPTION OF A NEW CARANGID FISH FROM NEW JERSEY

BY HENRY W. FOWLER.

Curator of Fishes, Academy of Natural Sciences of Philadelphia

The new fish described in this paper was secured by Mr. Charles Heid in the fish pounds at Manasquan, and presented to the Academy which is indebted to him for this valued gift. It is an interesting species of Carangidae, belonging to the genus *Uraspis* of Bleeker 1855. These are the white mouthed crevalles, remarkable for their conspicuous white tongue and adjacent region inside the mouth, sharply contrasted with the gray-black walls. A second genus, *Leucoglossa* Jordan, Evermann, Tanaka 1927, differs in the structure of the scutes forming the lateral line. In *Uraspis* each longitudinal spine of the scute is furnished with a forwardly directed denticle, while in *Leucoglossa* there is only the posteriorly directed spine. In all other previously described species of these genera, so far as known, the first dorsal and anal rays are the longest rays of their respective fins, and the ventral fins are distinctly shorter or at least not longer than the head. The new species is of further interest as placing definitely in the Atlantic fauna a representative of a group of species heretofore believed confined to the Indo-Pacific.

Genus **URASPIS** Bleeker

PLATYURASPIS, new subgenus

Body oblong, deeply ovate or depth less than half length without caudal, strongly compressed, with tail short and little tapering. Head moderate, deep, compressed, occipital region well elevated, with evenly convex profile. Snout short, broad, profile moderately inclined. Eye moderate, slightly advanced in head from center, and without adipose lids. Maxillary well inclined, reaches below front of eye; supplementary maxillary large, rather narrow, well developed. Mouth moderate, lower jaw projecting in front. Teeth conic, strong, simple, in narrow band, gradually smaller posteriorly in jaws. No teeth on palate or tongue. Nostrils similar, close together, level with upper part of eye, little nearer eye than end of snout. Inter-orbital well elevated, with median ridge. Opercle with feeble radiating striae. Gill membranes free from isthmus. Gill rakers moderate, lanceolate. Scales on body minute, irregular. Head largely naked, except on upper part of postocular region and cheek. Straight section of lateral line much longer than curved section, scutes along side of caudal and posterior part of tail large, strong, and each keel forms a broad or obtuse compressed cuneate front point, directed forward, while on some of largest scutes the posterior end may have a small or inconspicuous point as well. Caudal base scaly, fins naked otherwise. Dorsal spines low, pungent, graduated to fourth which longest. Soft dorsal high, antero-median rays longest and contour of

fin rounded anteriorly and posteriorly, over twice high as spinous dorsal or $2\frac{3}{4}$ in greatest body depth. Soft anal little shorter than soft dorsal, similar. Two small, short, strong, close set anal spines before soft anal, posterior spine longer. Pectoral moderate, broad, not falcate, not quite reaching beginning of straight section of lateral line. Ventral equal to little longer than head, inserted slightly before pectoral origin and reaches back little beyond front of soft anal. Type *Uraspis heidi*, new species.

The species described below differs in a number of important details, and therefore seems worthy of at least subgeneric rank. Chief among these are the different and deeper contour of the body, elevated soft dorsal and anal fins without any distinct anterior lobes and with the first few rays gradually longer (not the first ray the longest ray of the fin), the longer ventrals, general coloration more or less dark neutral green with pale narrow cross bars but not extending on soft dorsal and anal, and all fins blackish except yellowish caudal base and pale pectoral. In agreement, however, is the structure of the reversed cuneate spine on the front of each scute in the straight section of the lateral line; the bright or milk-white color of the entire tongue and the greater part of the roof of the mouth and the lower front part of the mandible, this contrasting greatly with the deep gray black surrounding color of the inner walls of the mouth. As figured by Wakiya in 1924 his drawing of *Caranx* (*Uraspis*) *uraspis* Günther differs in many ways. It shows the broad pale bands but little narrower than the alternating dark ones, and extending on the soft dorsal and anal fins become broader, on the anal shown as greatly wider than the dark bands. The curved and straight sections of the lateral line are shown as subequal, or the arch about $1\frac{1}{2}$ in the straight section (in my example $1\frac{1}{4}$). He shows the snout tip slightly below the level of the lower rim of the eye (in my specimen the snout tip is higher, or level with the lower rim of the pupil). Wakiya's specimen given as 172 mm. without the caudal I compute to about 207 mm. with the caudal.

($\pi\lambda\alpha\rho\upsilon\varsigma$ broad + *Uraspis*.)

Uraspis heidi, new species.

Depth $1\frac{9}{10}$; head $3\frac{1}{4}$, width $1\frac{1}{4}$. Snout $3\frac{1}{2}$ in head from snout tip; eye 4, $1\frac{1}{2}$ in snout, $1\frac{1}{4}$ in interorbital; maxillary reaches $\frac{1}{2}$ below eye, expansion $1\frac{3}{4}$ in eye, length $2\frac{1}{4}$ in head from snout tip; teeth irregularly biserial in jaws, and all along outer bases of their insertion grayish, in contrast to narrow black strip inside along their inner bases, this in turn greatly contrasted by larger cream or milk white area on middle of mouth roof and white post-symphyseal blotch; interorbital $2\frac{3}{4}$, convexly elevated. Gill rakers 6 + 15, pointed, $1\frac{1}{2}$ in gill filaments or $1\frac{3}{4}$ in eye.

Scales on head only present on postocular region, small area on upper part of opercle, and batch on upper front part of cheek, where in 9 series transversely, broad lower part of cheek and preopercle flange naked. Chest and breast entirely naked below, area extends back to ventrals and less than half way up to pectoral. Tubular scales in arch of lateral line 45, and scutes in straight section 34; depth of largest scutes $1\frac{1}{2}$ in eye.

D. VIII, 1, 28, 1, fourth spine $3\frac{1}{2}$ in total head length, eighth ray $1\frac{3}{4}$; A. II—1, 22, 1, third ray $1\frac{3}{4}$; caudal 1, lobes broad and rounded, fin little emarginate behind; least depth of caudal peduncle $4\frac{3}{4}$; pectoral $1\frac{1}{2}$, broad, rays II, 21; ventral rays 1, 5, fin $1\frac{1}{10}$ times head.

Color when fresh, olive green generally, with 8 narrow paler or light gray transverse or vertical bands, each greatly narrower than darker interspaces. Head and base of caudal with brighter olive to yellowish shades. Iris dark gray. Fins all more or less gray black, well contrasted with rest of fish. Lower front edge of anal and end of each caudal lobe white. Pectoral grayish or little paler than other fins.

Type, A.N.S.P. No. 68453. Manasquan, New Jersey. September 3, 1938. Charles Heid. Length 273 mm.

Known only from the above described specimen, kindly forwarded to the Academy for Mr. Heid by Mrs. Arthur G. Howes, who described its color as "olive green on back and sides, with white lighter vertical streaks" when fresh, though when the specimen reached me these colors had hardly faded. At this writing they are still evident in alcohol.

(For Mr. Charles Heid, of Manasquan, who has procured interesting fishes from his region for the Academy.)

As the species of *Uraspis* and *Leucoglossa* are rare in collections and but few specimens have been reported, the following list is given, those with the asterisk having been examined by the writer:

Uraspis carangoides (Bleeker). Nias, Amboina, Riu Kiu, Nagasaki.

Uraspis reversa Jordan, Evermann, Tanaka. Honolulu.

Uraspis helvola (Schneider)*. Society Islands, Japan.

Uraspis riukiensis Jordan, Evermann, Tanaka. Riu Kiu and Kii, Japan.

Uraspis pectoralis Fowler*. Philippines.

Leucoglossa candens Jordan, Evermann, Tanaka*. Honolulu.

Leucoglossa albilunguis Jordan, Evermann, Tanaka. Honolulu.

Leucoglossa herklotsi Herre. Hong Kong, China.

NOTES ON FROGS OF THE GENUS *ACRIS*

BY EMMETT REID DUNN

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Percy Viosea, Jr., has maintained for some time that *Acris* is composed of two distinct species, *gryllus* and *crepitans*. He has given some characters and ranges for the two (1923, Copeia, 115, p. 9; in Wright and Wright 1933, Handbook of Frogs and Toads, p. 82). In the former paper both are stated to occur in Louisiana, "the up land species being tentatively *gryllus* and that of the lowlands *crepitans*" and in the latter *gryllus* is given as a pine-barren Atlantic Coastal Plain form extending to the Florida Parishes of Louisiana, and *crepitans* a Mississippi Valley or more western form.

Examination of the collections of this Academy confirms Viosea's opinion that two distinct species are involved, and the distinguishing characters are those he mentions. The ranges are, however, sufficiently different to warrant publication of the following notes.

Rana gryllus LeConte (1825, Ann. Lyc. Nat. Hist., New York, 1, p. 282) was described without type locality, and without designated type. It would be natural to consider the LeConte plantation at Riceboro, Georgia, as the most likely source, and to consider U.S.N.M. No. 3564 (five specimens), U.S.N.M. No. 5909 (seven specimens), and A.N.S.P. Nos. 1989-90, all from LeConte and labeled "Georgia" as the nearest approach to types that we are likely to get. Viosea has sent me Louisiana specimens of what he calls *gryllus*, and they agree perfectly with these LeConte specimens.

Acris crepitans Baird (1854, Proc. Acad. Nat. Sci. Philadelphia, VII, p. 59) was described from "Northern States generally". No type was designated. Baird mentions a New York specimen figured by DeKay (1842, Zool. New York, Reptiles, p. 70, pl. 22, fig. 61, "in cabinet of the Lyceum") and this may help to fix the name.

I have seen no specimens from New York, but specimens from Bucks Co., Pa., agree quite well with Louisiana specimens which Viosea considers *crepitans*.

This Academy possesses specimens of *Acris gryllus* from the following localities: Southport, N. C.; Manning, S. C.; Thomasville, Ga.; Caloosahatchie, Fla. I have seen specimens in the U. S. National Museum from extreme southeastern Virginia. The range is, therefore, from Virginia to Louisiana along the coast.

We have *crepitans* from many New Jersey localities in the counties of Warren, Summerset, Sussex, Mercer, Burlington, Cumberland, Camden,

Gloucester, and Cape May. In Pennsylvania we have it from the counties of Bucks, Philadelphia, Delaware, Chester, and York.

DeKay (above) has recorded it from New York, and Cope (1889, Bull. U. S. Nat. Mus., XXXIV, p. 460) has recorded it from New Haven, Connecticut.

This Academy has *crepitans* from Maryland, Delaware, Virginia, North Carolina, Illinois, Georgia, Mississippi, Tennessee, South Dakota, Kansas, Arkansas, Oklahoma, and Texas.

Stejneger and Barbour (Checklist, 3rd ed., 1933, p. 31) give "the Canadian Northwest Territories".

It is entirely possible that careful study may show that western specimens differ from typical northeastern *crepitans*, although I have noticed no marked differences such as those that separate *crepitans* from *gryllus*.

I have taken *crepitans* at Midway, Nelson Co., Va., in the Piedmont, and near Brevard (2000 ft.) in the French Broad Valley, N. C.

The range of *crepitans* may be defined as from Connecticut to the Canadian northwest, and to Georgia, Louisiana and Texas; from sea level to 2000 feet.

In the State of Virginia I have seen *gryllus* from the counties of Norfolk and Elizabeth City; *crepitans* from the counties of Fairfax, Arlington, Fauquier, Caroline, Prince William, Prince Edward, Nelson, Albermarle, Dinwiddie, Mecklenburg; and west of the Blue Ridge from Bath, Clarke, Rockbridge, and Wythe.

The best character for distinguishing the two species is the amount of webbing of the toes, *crepitans* having much more web.

<i>gryllus</i>	<i>crepitans</i>
smaller.	larger.
less web (3 phalanges of toe 4 free, toe 1 partly free).	more web (2 to 1½ phalanges of toe 4 free, toe 1 completely webbed).
more rugose.	smoother.
anal warts less prominent.	anal warts more prominent.
legs longer, heel beyond snout.	legs shorter, heel not to snout.
thigh more definitely striped.	thigh less definitely striped.

No difficulty whatever has been experienced in sorting the material in the Academy series into two species on the basis of the characters given above. According to Viosca, the two may occur together in Louisiana, and our specimens bear this out as we have both species from Southport, N. C. and Thomasville, Ga.

I have been unable to locate the types of *Rana dorsalis* Harlan (1827, Journal Acad. Nat. Sci. Philadelphia, V, p. 317; 1835, Med. Phys. Res., p. 105, fig., p. 72) from Florida, or of *Acris acheta* Baird (1854, Proc. Acad. Nat. Sci. Philadelphia, VII, p. 59) from Key West. These names have usually been relegated to the synonymy of *gryllus*.

**ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SOUTH PACIFIC
EXPEDITION OF 1937. PART II,—THE BIRDS OF
MALPELO ISLAND, COLOMBIA**

BY JAMES BOND AND RODOLPHE MEYER DE SCHAUENSEE

Department of Birds, Academy of Natural Sciences of Philadelphia.

The island of Malpelo, which belongs to the Republic of Colombia, lies approximately 330 miles from the mainland of that country, and about the same distance from the Azuero peninsula of Panama. Its position is 3° 40' N. Latitude and 81° 24' W. Longitude.

It is slightly more than a mile long and attains a height of about 800 feet at its center. To the north and south of it are a number of small rocky islets.

Townsend,¹ the first scientist to visit the island, collected some lizards and the Swallow-tailed Gull in 1891. He reported that a variety of sea birds frequented Malpelo. Murphy says "The identity of these has never been determined but Noddies and perhaps Fairy Terns would be probable members of the avifauna."²

Mr. Vanderbilt and his party were fortunate to effect two landings on Malpelo, and several species of birds were collected there for the first time.

The following account of Malpelo is taken from the diary of Ronald Smith, Mr. Vanderbilt's collector.

"On the 8th of February, Malpelo Island was sighted in the grey dawn several miles ahead as a gaunt, bleak pinnacle of rock jutting up from the sea . . .

"Most of the island seems composed of solid lava rock formation with here and there immense bubble-like structures and volcanic ash. There were great quantities of loose lava fragments on the summit and the rocky cliffs.

"As we started up, crawling over the nests of boobies and gulls, we came to a more gradual slope but with more loose rock . . .

"Several small streams of water were noticed to have seeped through the lava and were trickling down the cliffs from heights of about one hundred feet. This water was strongly alkaline.

"About six hundred feet up we reached a sort of plateau, one of the most barren, bleak expanses of rock I have ever seen. Not a single plant or shrub, living or dead was to be found. Acres of lava clinker were cov-

¹ Bull. Mus. Comp. Zool., 27, p. 125, 1895.

² Oceanic Birds of South America, I, p. 320, 1936.

ered in all directions by booby nests. Some small pools of black scummy water were found in several places.

"A continual chirping, seemingly identical to that of crickets, was heard wherever we went on the island. The originators of this sound were not found. Small black flies or gnats were very abundant and we were continually pestered by them until we got off the island.

"After about two hours' climbing we reached the summit and had a splendid opportunity to see the whole island from above. It was an impressive sight—a volcanic, desert island without any vegetation on its summit, standing like a pinnacle out of the sea, mainly inhabited by boobies and lizards, with seething white surf pounding against the cliffs on all sides.

"The only vegetation found on Malpelo was on a steep cliff about 200 feet high. Here there was a moss and a grass growing from the damp crevices . . .

"On the northeast, as well as the southwest, of the island were several small pinnacles of rock jutting straight up from the ocean to heights of a hundred feet or more. These were covered with boobies while on one, the most outlying of the southwestern group, several dozen Man o'War Birds were nesting."

ANNOTATED LIST OF THE BIRDS OF MALPELO ISLAND

1. *Sula dactylatra granti* Rothschild. Masked Booby.

Two adult males were collected February 8, and an immature female February 9.

2. *Fregata* sp.

None collected but Smith notes "Man o'War Birds 50; small colony on one of the outlying rocks on the southwest of the island."

3. *Falco peregrinus anatum* Bonaparte. Duck Hawk.

Not collected but two birds observed twice by Smith on Malpelo Island.

4. *Actitis macularia* (Linnaeus). Spotted Sandpiper.

Not collected but "ten seen in company with tattlers."

5. *Heteroscelus incanus* (Gmelin). Wandering Tattler.

One male and two females, in winter plumage, were collected February 8 and 9. About twenty-five individuals were seen.

6. *Creagrus furcatus* (Neboux). Swallow-tailed Gull.

An adult male and female as well as a nestling were collected February 8 and 9. Smith records a colony of thirty birds on the island.

7. *Anous stolidus ridgwayi* Anthony. Noddy.

An adult female, the only specimen seen, was secured February 9. It was not in breeding condition.

8. *Anous minutus diamesus* (Heller and Snodgrass). Black Noddy.

An adult male collected February 9, was the only specimen seen. The bird was not in breeding condition.

9. *Hirundo rustica erythrogaster* Boddaert. Barn Swallow.

An immature female was secured February 8. Four birds were seen flying out of a cave.

10. *Progne* sp. Martin.

Recorded by Townsend but none secured. Smith did not see any martins.

EXPLANATION OF PLATES

PLATE 9.

Fig. A.—Malpelo Island from the sea.³

Fig. B.—Landing on Malpelo.³

PLATE 10.

Fig. A.—Shore-line of Malpelo Island.³

Fig. B.—View from summit of Malpelo.⁴

PLATE 11.

Fig. A.—Masked Booby on nest.³

Fig. B.—Malpelo lizard.³

³ Photograph by Mr. George Vanderbilt.

⁴ Photograph by Mr. Ronald W. Smith.

ZOOLOGICAL RESULTS OF THE SECOND DOLAN EXPEDITION TO WESTERN CHINA AND EASTERN TIBET, 1934-1936. PART I,—INTRODUCTION

BY BROOKE DOLAN, II.

Research Associate, Academy of Natural Sciences of Philadelphia

PURPOSES AND PLANS

In January of 1934 the time seemed to me ripe for an extensive expedition into Western China, Eastern Tibet, and the Kokonor, to secure collections of mammals, birds, and mollusca which would interlock wherever possible with those collections secured by the First Dolan Expedition to Western China and Eastern Tibet in 1931-32, of which the Academy of Natural Sciences of Philadelphia was sponsor and beneficiary.

The purposes of the Expedition were set forth to Mr. Charles M. B. Cadwalader, President (at that time Managing Director) of the Academy of Natural Sciences as follows:

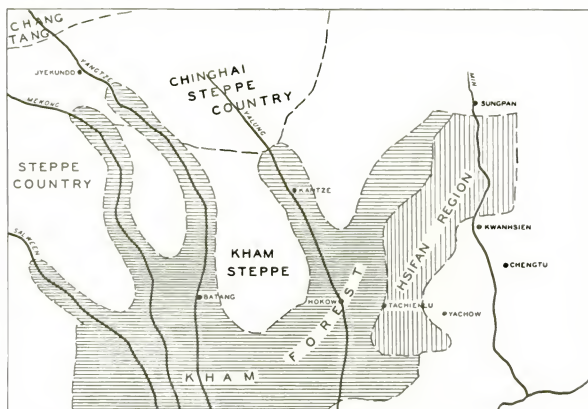
1. To secure systematic collections of Khams and high Tibetan fauna.
2. To obtain the large mammals of Tibet for the erection of life groups in the Academy's Museum.
3. To unravel the problem of the large Cervidae of the East Tibetan border.
4. To explore the Eastern and Southeastern slopes of the great snow-range Amnyi Machen in Kokonor.

1. *Systematic Collections.*—As in 1931, systematic collections of mammals, birds, and land shells, were to constitute our chief objectives and intensive collecting was to begin where we left off in 1931, subject, of course, to difference in seasons, hiatuses in our 1931 collections, etc. In 1931 the nucleus of our collections was made in Szechuan Province of China along the high mountainous marches of Tibet and China considered geographically, although not drawn on present political lines. This region of Himalayan or older formation was in early times entirely inhabited by folk of Tibetan stock (the 18 kingdoms of Chiarong) and the Chinese epithet for them "Hsifan" (the Western Tribes) has been applied by zoologists to the fauna of the region.

Our collecting (in 1931) began in Wassu, a dense rain-forest, in April; in June and July we explored north and northwest of Sungpan, which Dr. Hugo Weigold ("Süd-ost Tibet als Lebensraum") sets as the northerly limit of the Hsifan fauna. Northwest of Sungpan we touched the edge of the Tibetan steppe. In September and October we worked around

Tachienlu, which the above author sets as the western limit of the Hsifan fauna. On the road home Dr. Weigold and Mr. Schäfer again touched the edge of the Tibetan plateau country between Tachienlu and Baurong, collecting en route from Tachienlu in Szechuan via Hokow, Baurong, Yungning, Likiang, and Tengyueh, to Bhamo on the Burma border, east of Mandalay.

Thus in 1931, the First Dolan Expedition concentrated its efforts on the Hsifan fauna of the border ranges, although collecting along the entire route. In Wassu (of the same character as Moupin, Pére Armand David's famous collecting ground) we worked for seven weeks in the rich center



TEXT-FIGURE 1. Map of Faunal Areas of Eastern Tibet. After Hugo Weigold.

of Hsifan. Around Sunpan, on the road to Tachienlu, and near the latter city, we worked the northern and western perimeters of the Hsifan area, which are far poorer due to greatly reduced rainfall and show considerable invasion of Tibetan and Siberian forms. Rainfall is unquestionably the key to the rich fauna of Wassu, Moupin, and the northern Lolo country. As the monsoon clouds are tapped by successive mountain ranges, the precipitation declines and flora and fauna grow successively poorer.

Intensive collecting of The Second Dolan Expedition was to begin on the western perimeter of Hsifan at Tachienlu and be carried on from July of 1934 until September or October of 1935 along a circle which the expe-

dition would describe westward through Khams to Batang (collecting what Dr. Weigold described as the Kham-fauna under the title cited above), northward and westward to Jyekundo; then northward to the source-waters of the Yellow River in the high Tibetan country of Kokonor where we hoped to secure systematic Tibetan collections; eastward to cross a northerly spur of Amnyi Machen and down to Radja Gomba on the Yellow River; finally southward and eastward across Gnaba to Sungpan and down the Min River to Chengtu, thus completing the circle, the trip to consume roughly fifteen months.

2. *Specimens for exhibit*.—In 1931, The First Dolan Expedition had been fortunate enough to secure adequate specimens of two rare mammals peculiar to the Hsifan marches: the Giant Panda (*Ailuropoda melanoleuca*) and the Tibetan Takin (*Budorcas tibetana*). Thanks to the generosity of my mother, Mrs. Thomas J. Dolan and several friends of the Academy, it was possible to erect habitat groups of these two animals in the Museum.

In 1934-5 the Expedition proposed to collect specimens of the high Tibetan large mammals, for exhibit in the museum of the Academy. The Tibetan mammals were to include: the wild yak; the wild ass or kiang; the chiru or Tibetan antelope; the goa or Tibetan gazelle; the steppe bear and whichever wild sheep we should find in the Amnyi Machen, (*O. ammon comosa* or *O. a. hodgsoni*?).

3. *The large Cervidae of Eastern Tibet*.—These were slightly known to us from the First Dolan Expedition. Near Sungpan we had purchased a large set of dark rough maraloid antlers and referred them tentatively to *C. canadensis kansuensis* of the Min Shan, a forested range just north of the border of Szechuan and Kansu provinces. In Tachienlu and Sungpan and on the road we had seen horns both in the velvet and dry. Tibetan hunters near Sungpan spoke of only one stag: "ma lu" or horse deer, but around Tachienlu we heard of two, "hung lu", the red deer, and "pei lu", the white; the conjecture as to the identity of these deer was never absent from my mind. Could one of them represent the stag to that hind shot so long ago by Capt. M'Neill near Litang, named in his honor *C. cashmiriensis macneilli*?

4. *The Wilderness of Amnyi Machen*.—Thanks are due to Dr. Joseph Rock for our interest in the wilderness to the east, and under the shadow of Amnyi Machen, the great unmeasured snowpeak that has drawn explorers like a lodestone, he told me of seeing big-horned sheep called "nien" by the natives (nihn is the name in S. Tibet for big-horned sheep). He saw stag there also. He explained the quantity of animal life as being under the protection of the Abbot of Radja Gomba. We planned to visit Radja and gain the confidence and support of the Abbot for an exploration of this region.

PERSONNEL

There was no question in my mind as to the two men best qualified for an expedition into Eastern Tibet. Mr. Ernst Schäfer (now Dr. Schäfer) had collected birds for the First Dolan Expedition of which Dr. Hugo Weigold had been chief ornithologist. Dr. Schäfer's rifle had also been responsible for the bulk of the mammal collection. He accepted my invitation to take charge of mammal and bird collections for the Second Dolan Expedition. Mr. Marion H. Duncan had served for ten years with the Disciples of Christ Mission at Batang on the border of autonomous Tibet. He could speak both Chinese and Tibetan. He believed that he could enlist the services of six to ten Tibetans at Batang for a journey into Tibet and the Kokonor. Mr. Duncan accepted my invitation to serve as interpreter and take charge of native personnel, commissary, and transport.

PROCEDURE

On May 10, 1934, Mrs. Dolan and I reached Shanghai on the S. S. President Coolidge. We were joined a week later by Ernst Schäfer, who arrived via Suez on a North German Lloyd Liner. Marion H. Duncan reached Shanghai in June.

At Nanking Mr. Wyllis Peck, Counsellor to the U. S. Legation (now the Embassy), took me to see Dr. S. S. Liu, Chief of the Department of European and American Affairs in the Chinese Foreign Ministry. I presented my request to Dr. Liu for passports and for free entry of equipment into China. Permission for the latter would have to come from the Ministry of Finance and, as specially relating to arms, ammunition and field glasses, from the Ministry of War.

Official action, however, is contingent upon the attitude of the powerful semi-political Academia Sinica toward any scientific project. To Dr. Tsai Yuan-pei, the President of that organization, we presented our Academy credentials, and he referred us to Mr. Wu, the Director of The Metropolitan Museum of Natural History in Nanking. Dr. Chi Ping, President of The Science Society of China and an old friend, also recommended us highly to Mr. Wu with whom we concluded a co-operative agreement whereby we invited the Metropolitan Museum to participate in the Expedition and promised to present that institution with duplicates of all biological specimens represented in the collections to be made during 1934 and 1935. Mr. Wu then wrote to Dr. Liu in the Foreign Ministry, and in due course of time we received duty exemption, passports, and gun licenses. This procedure, while rather complicated, repays all parties concerned in the long run. It protects the Foreign Ministry from issuing passports to adventurers on quests of pure exploitation, and the special passport issued by the Foreign Office carries great weight.

On July 10 we embarked, with all of our equipment, on the S. S. Ichang of the Yangtze Rapids Line cleared for Hankow, Ichang, and Chungking. On July 13 we reached Hankow where Mrs. Edgar Hykes of the Standard Oil Co. generously entertained our party. On the 17th we left Ichang, the former head of steam navigation, and entered the famous gorges of the Yangtze reaching Chungking, the start of our overland trek on July 20.

In Chungking Mrs. Dolan and I were very kindly entertained by Mr. and Mrs. A. E. Fitzsimmons of the Standard Oil Co. Mr. C. C. Chang, director of the Bank of China for Szechuan and Mr. Djiao of the Chungking Branch were extremely helpful to us, as were also Mr. Lee of the Chinese Maritime Customs and Mr. Ho, Chief of the Navigation Bureau. Mr. Hsiao, Foreign Secretary for General Liu Hsiang, issued us passports for Chengtu and arms' permits for central Szechuan. Mr. Balnson, the owner of the Ford Agency, arranged hire for us of two lorries for our equipment and for ourselves a touring car for the new motor road to Chengtu.

Mr. J. R. Schwer, of the Chungking Ice Company, was helpful to us in many ways. As in 1931 he offered his head boy Lee to us and we formed the nucleus of our staff with Lee as No. 1 boy, Tsai Kwei-fu, bird skinner in 1931, in his former capacity, and Ts'ang Wen-ch'ing, a cook who had been with Duncan before. All three men served faithfully throughout the expedition.

On July 24, my wife returned to Shanghai in a China National Aviation Co. ship; there she met my mother, Mrs. Thomas J. Dolan, who had travelled out to China to join her.

On July 25 the expedition left Chungking with its motor caravan driving the 250 odd miles to Chengtu in two days. Chengtu is the capital city of Szechuan province's forty millions and is the seat of West China Union University. Messrs. Small and Dickinson entertained us on the campus and, I hope, forgave us for the general air of pandemonium we injected into their orderly bachelor's mess. Mr. Small arranged our porter train to Yachow, the first lap of the Tachienlu road. While we were in the far interior he helped us virtually with mail, money and supplies.

With Mr. Dickinson as interpreter we called on Field Marshal Liu Hsiang, the Governor of the province. Field Marshal Liu was elected an honorary life member of the Academy in 1931 for his kind co-operation with our first expedition. We presented our Nanking passports and he ordered a provincial pass to be issued to us.

The expedition expense account was with the Bank of China and from the main office at Shanghai we had credits transferred to the Chungking and Chengtu branches. Mr. Cavalieri, the Postal Commissioner at

Chengtú, cashed our checks and forwarded orders to us in Tachienlu to be cashed on the local post office. All money was handled so while we were in the far interior, checks on Tachienlu being cashed in our absence by Mr. Robert Cunningham, of the China Inland Mission, who either forwarded cash by caravan or arranged credit with merchants who traded with interior markets. Mr. Cavalieri has been a friend to expeditions for many years and did everything possible to help us, both in 1931 and 1934-35.

THE EXPEDITION IN THE FIELD

Our baggage train of porters left Chengtú on July 30 and on August 5, two days late, thanks to the monsoon and a heavy spate of the River Ya, we reached Yachow where we were the guest of Miss Shurtlieff of the American Baptist Mission. Gen Liu Wen-hui, Border Pacification Commissioner, through Gen. Hsiang, his second in command, issued us strong passports for the new province of Sikong which consists of Chinese Tibet or Khams west of Tachienlu. He was kind enough to telegraph news of our coming to every military outpost on the border.

Bird collecting was begun at Chengtú and collections of birds and mollusca were made on the road to Yachow and Tachienlu.

At Yachow (elev. 2000 ft.) a caravan of horses and mules was engaged and on September 20, three days late, after floundering across the mud slides of a heavy monsoon, we reached Tachienlu. Mammal collecting began at Waszekou (also Wa-su-kou) on the Tung River, a half-day's ride below Tachienlu. Schäfer shot two immature goral (*Naemorhedus goral griseus*) on the north slope of the Tachienlu stream just west of its juncture with the Tung.

In Tachienlu (elev. 8900 ft.) we were welcomed by our old friends, Mr. and Mrs. Robert Cunningham and Mr. and Mrs. J. Huston Edgar, of the China Inland Mission. Only the members of the expedition can appreciate the generous and unflagging assistance rendered them by Bob Cunningham.

Serious mammal collecting started in the end of August two days north and northeast of Tachienlu on the road to the valley of Kongyu which drains east into the Tung. We collected there a series of Tibetan takin (*Budorcas tibetana*), a serow (*Capricornis sumatrensis milne-edwardsii*), and a blue sheep (*Pseudois nayaur szechuanensis*). On the Tachienlu Mountains just north, northwest and north-northwest further up the valley, Schäfer trailed a stag which the natives ascribed to "Hung lu", the red deer. "Hung lu" we eventually discovered to be the white lipped deer (*Cervus albirostris*). If the natives were correct, this would fix what we now feel sure represents the eastern limits of its range.

Duncan meanwhile had been preparing our first Tibetan caravan including three Tibetans, Gegen Atring, Trelay, and Lobsang Dendru, who had come to join us from Batang.

On September 8 we left Tachienlu with a hired caravan of yak for Hokow, crossing, on September 9, the Cheto La, a 14,200 ft. pass which represents, as pointed out in "Plans and Purposes", a definite divide between the fauna of the Hsifan marches and that of Khams or Southeast Tibet. From the pass the vista to the west is topographically Tibetan (Plate 12), younger and more gentle of contour than the deep cut trenches and precipitous ranges of the Hsifan country. The heavy monsoon is behind. Larch appears as we descend and dwarf rhododendron takes the place of the large shrub. Partridges and ravens are in plenty.

On September 14 we reached Hokow (elevation 9400 ft.) and shot a fine series of goral in the limestone cliffs above the Yalung (Tib. Nyachuka) River.

On September 16 we crossed the Rama La (a 15,000 ft. pass) and at Camp 11 collected the first goat (*Procapra picticaudata*). Between the ditches of the Yalung and the Yangtze, a twisting tongue of Tibetan plateau-land or neo-steppe forces its way southward although beset by valleys tributary to the two rivers bearing the typical forests of Khams. Gazelles, wolves, cranes, storks, ruddy sheldrake, larks and pipits, are character forms of the plateau. In the forests of the tributary valleys,—spruce, birch, poplar, fir and prickly oak,—are the white-lipped deer, M'Neill's deer, musk deer, tufted deer, serow, and steppe bear (Plate 15).

Litang we reached on September 26. The Tibetan market, lamasary, and Chinese garrison lie on the edge of a huge plain at an elevation of 13,800 ft. The plain of Litang teems with life. We collected there gazelles, cranes (*Grus nigricollis*), black stork (*Ciconia nigra*), lammergeier (*Gypaetus barbatus aureus*), many larks, pipits, and passerines between September 26 and October 15 (Plate 16). Two and a half days southeastward on the fringes of Malashi (Camps 18, 19, 20) we hunted large deer and saw one stag which we had reason to believe represented the white-lipped deer. In the Litang market we saw many antlers both of white-lipped and M'Neill's deer, although at that time we could not identify the latter.

From Litang we crossed the principality of the Yura Bönbo or Washi Prince in company with several merchant caravans banded together for protection against raiders from Shangcheng. On October 24, after an 8-stage march we dropped down into the arid, agricultural (irrigated) valley, and town of Batang (elev. 8600 ft.).

The ruined mission of the Disciples of Christ, Marion Duncan put at our disposal and there we spent the early winter working into the mountains

northeast, east and southeast of Batang and down the trench of the Yangtze to Leh and Drupalong.

The Yangtze River near Batang runs at circa 8000 ft. elevation in a deeply carved gorge. The range east of the river rises to peaks of not less than 18,000 ft. elevation. Inasmuch as the largely exhausted monsoon rain-clouds require high elevations for precipitation, resulting in a ribbon of forest with timber line below as well as above, the life-zones run the gamut from neotropical to alpine. Therefore, in order to explain the great differences in fauna perhaps ascribed to one locality in our collections, I divide the fauna and flora of the Yangtze slope into rough elevational groups, citing characteristic forms familiar to me which I hope will serve as adequate sign-posts to the general ecology.

The Kham Forest at Batang

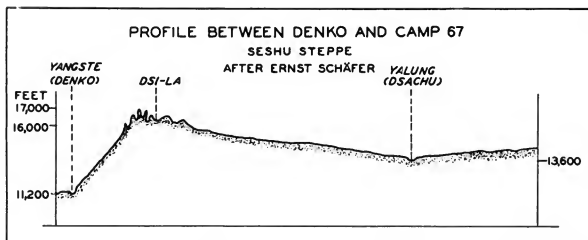
1. The arid zone: from the river bank at 8,300 ft. to 10,000 ft. Flora: stipa grass, cotaneasters, barberry, artemesia, roses, plums. Large mammal fauna: leopard, sambhar, goral, blue sheep.
2. Lower edge of forest belt: from 10,000 to 11,500 ft. Flora: Prickly oak (*Quercus ilex*), pine, birch, poplar. Fauna: sambhar, serow, tufted deer, musk deer.
3. Heavy forest belt: from 11,500 ft. to 13,000 ft. Typical forest of Khams. Flora: prickly oak, birch, fir, spruce, rhododendron. Fauna: bear (*Ursus arctos pruinosus*), lynx, serow, musk deer, white-lipped deer, and probably M'Neill's deer (Plates 13 and 14).
4. Alpine zone: from 13,000 to 17,000 ft. Flora: rhododendron, spruce up to 14,500 ft., dwarf rhododendron and grass to undetermined elevation. Fauna: musk deer, white-lipped deer, probably M'Neill's deer, bear, lynx, snow leopard, and blue sheep.

All mammals cited in this division were secured by the expedition while at Batang with the exception of M'Neill's deer and the leopards. Collections of mammals, birds, and mollusca, we sent back from time to time with merchant caravans to Mr. Robert Cunningham in Tachienlu for storage in rooms hired by us for that purpose in a Tibetan house.

In the end of December we began to organize and round out our staff of Tibetans; to buy supplies, additional equipment, and riding animals for the journey to Kokonor. On January 20 we set out with a convoy of 60 mules hired from Ba lama for the trip to Jyekundo. The first stage, due to the necessity of avoiding the country of the Deco Diemba, at war with the garrison in Batang, proved to be a 17-day detour eastward, northward and northwestward, to regain the Derge road at Sama. This road, unfortunately, entailed backtracking toward Litang and crossing five passes of circa 16,000 ft. elevation; it put out of commission permanently the riding horses which we had been foolish enough to buy (instead of hire) in Batang (Camps 29-26, 36-41).

From Sama (Camp 41) we travelled via Denna (Dene) Tang, Beyü (Pehyul), Horbo, and Sotong to Derge (Dege) Göichen (Camp 52), the chief lamasary of the Sakyapa in Eastern Tibet. Beyond Derge at least as far as Jyekundo and back to Kanze in the east we had before us a large area unexplored by naturalists. Weigold had been in Derge and Kanze; Kozlov in Jyekundo; but the big triangle between these three towns was a mystery which we were eager to explore.

From Derge on February 16 we set out north again, travelling via Göze Gomba and Nojeling Gomba to Denko (Camp 58) on the upper Yangtze River. We were entertained there by the magistrate and the major of the Chinese garrison obtaining by their good offices fresh supplies of wheat and barley (rice being a delicacy only) before crossing, on February 24, the Dsi La, a 15,800 ft. pass onto the first steppe of topographical high Tibet. This is the steppe of Seshu, sloping down to the Upper Yalung (Text fig. 2), and would have been a surprise of the first



TEXT-FIGURE 2. Profile of the Tibetan steppe of Seshu. Modified after Ernst Schäfer.

water had we not been regaled by Chinese officials on the road with accounts of the strange animals to be found there. Just below the pass we found skulls of *Ovis ammon hodgsoni* and heard, for the first time, the name "nien" or "nihn" by which the Tibetans describe the argali. We reached the garrison of Seshu (Ju Gomba) (Camp 61) on February 25 and on a three day hunt secured a series of wild ass or kiang (*Equus hemionus kiang*) establishing a record for Szechuan Province.

Seshu represents the first high steppe of Kokonor Tibet (Plate 18), extending down from the Chang Tang or Great Northern Plain of Tibet along the shores of the Dsachu or Yalung almost to Kanze.¹ The contours are extremely level, rising to low island-like ranges of granite, the habitat of the few *Ovis ammon* remaining in the region. Gazelles, wolves, foxes,

¹ Spelled "Kantze" on map and Text-fig. 1.

and steppe foxes (*Vulpes ferrilata*) were extremely plentiful, and steppe buzzards (*Buteo hemilaseus*). We saw falcons (*Falco cherrag milvipes*) but failed to secure any at this time.

At Seshu we were regally entertained by the magistrate who leads a terrible existence in this last outpost of the republic. Many soldiers die here of influenza, I suspect, for of our crew we had three men out for a week expecting to die of "poisonous winds".

Not until March 7 were we in fit condition to travel and then struck northward crossing the Yalung on March 9 and marching northwestward across a great steppe alive with kiang into the southeasterly end of the Baian Kara range, to be turned back by intense cold, lack of grazing and, most of all, by the determination of our guides to travel not one mile further northward (Plate 17). At Camp 66 we found the first wild yak horn and were told by our guides that they had not occurred here for many years. On our return to Seshu, Schäfer remained at Waterh (Wata) (Camp 62) to make collections while Duncan and I returned to Seshu, picking up Schäfer on March 19 at Seshu Gomba (Camp 68) on the final stage of the journey to Jyekundo (Camp 72), which we reached via the 14,700 ft. Ngamba La (pass), Sheru Gomba and Drebumdo on March 23.

Jyekundo is a market town of adobe caravanseries standing at the juncture of the Kokonor road with the Tachienlu-Lhasa tea road. It stands also on the boundary of three authorities, (Lhasa, Chengtu, Sining) so that we found there a military magistrate and a Brigadier General (?) commanding a large cavalry garrison and representing the Mohammedan authority of General Ma Pu-fang, the Governor of Kokonor, whose seat is in Sining. Both officials were resolved that we should proceed no farther either across the Yellow River, as planned, or in any other direction save back to Szechuan whence we came. Our staff they completely demoralized with tales of the Ngolok, the war-like nomads living in the knee of the Yellow River southwest of Radja. Ourselves they restrained from leaving the environs of the town, forbidding the use of their military wireless by which we might have communicated with the American Legation in Peking and thus had our case brought to the attention of the Ministry of Foreign Affairs.

On April 3 my gun bearer, Jimmy, whom we sent secretly out of Jyekundo, returned with two hinds of M'Neill's deer (*Cervus macneilli*) which he had shot a day and a half to the west of the town.

The local prince of that district, a strict lamaist, Jimmy was told, forbids any killing of the deer and has punished at least one offender by removing his hands at the wrists.

Gradually we seemed to have convinced the local authorities of the innocence of our hearts as well as of the firmness of our intention to carry

out our plans. We were one day given leave *sub rosa* to enlist guides and to purchase supplies and transport animals. On April 12, having signed documents releasing the officials from responsibility in any calamity that might befall us, we left Jyekundo, with our own caravan of fifty yak and five local guides in addition to our regular staff of eleven men, on the long road to Radja Gomba.

On April 14 we passed the village of Tongbumdo where Dutreuil de Rhins was murdered on June 5, 1894. On the following day we crossed the upper Yangtze, known to the Tibetans as Dreechu, at Lamdo, ferrying over in a huge bateau, the yak being driven in to swim across. Everyone was in high spirits; we were well on our way to Kokonor.

That evening, April 15, three soldiers, rode up the river on the Jyekundo road. As soon as I saw them, I knew the burden of their message. We were ordered, by the magistrate, to return to Jyekundo. A wireless had been received from the Foreign Office in Nanking that we were to proceed no farther. The message shown us looked spurious, and, deciding that our chances of bluffing the magistrate were fair, and that he would not dare any violence, we refused to comply. We agreed, however, to proceed no farther than Chinto, the last small military post on the road to Kokonor, and to parley there.

On April 17 we camped five miles beyond Chinto where there was grass for our animals, and in the afternoon I obeyed a summons to appear before the Lieutenant in charge of the post. His orders and his manner were unequivocal. We were to return to Szechuan Province immediately! We were not to remain a day longer in Chinto!

We would not return to Szechuan Province. We would stand on our reciprocal rights to travel anywhere in the Chinese Republic and remain in Chinto, dispatching a man to Kanze in Szechuan to send a wireless to the American Consulate, and we would shortly be authorized by the Chinese Foreign Ministry to proceed wherever we chose. As a stormy session seemed to be developing, I left and rode back to camp in very low spirits. The situation briefly was, that we had come a road of many months to be turned back at the very gates of Kokonor and Northern Tibet. In the face of such opposition, there seemed little likelihood of obtaining authorization from the Foreign Ministry, for the diplomatic representatives of the U. S. A. are unwilling to exert undue pressure in a suit such as ours, and an exchange of telegrams could not fail to establish the fact that we were not altogether welcome visitors to Kokonor.

One solution seemed possible, if not certain of success. We talked it over for hours, Schäfer, Duncan, and I. I should travel with Jimmy, and one of our Tibetan guides, Bozong, who was willing, and of whose courage Jimmy was satisfied, the 490 odd miles to Sining, there to interview General

Ma Pu-fang, the Governor of the Territory, and to put our plea before him. His permission wirelessed back to Jyekundo would set the expedition moving northward, and I would return to join the party at or near the Tossun Nor Lake.

I adopted the disguise of a Chinese merchant travelling across these wastes and, relying upon passing the last nomad encampments during the night, we set out with three mules and provisions for sixteen days, which is the time used by mail runners for the journey from Jyekundo to Sining. The route followed is shown on the map as "Dolan's Route" and is something over 400 miles in length. As I was unable to make collections en route, I will outline only the salient features of the trip.

On the first night we passed Drechu (Tongchi) Gomba from which the route is marked by cairns of sod as far as the Machu or upper Yellow River; nomad tribes, among them the Shuma, graze their yak and sheep in the watershed of the Dsachu or upper Yalung as far up as the benches below the Trala, the pass over to Machuka, as the drainage of the upper Yellow River is known. We were lost in a blizzard for three days on the road to the Trala which we reached on the ninth day out of Chinto.

The prospect looking northward over Machuka from the pass (Trala, or Chiala, elev. 15,500 ft.) was unbelievably desolate. The drainage and contours of the low wandering hills looked aimless to a degree, although the drainage is not actually indeterminate. Chocolate mud splotted with snow, and fading into the murky atmosphere of rapid evaporation was the texture of this uninviting wilderness.

Game is not plentiful at this time of year. The dead grass of the previous summer was close cropped by kiang and goa. Our mules, marching six hours a day across alternating steppes and low ranges of snow and mud with very sparse pasture, went down pitifully in the five days between the Trala and the Machu.

On May 2 we forded the Machu or Upper Yellow River, in spate from melting snows. Jimmy and Bozong were fortunate to reach the north bank. That night we saw the first and last party of Ngolok across the river. We raised our rifles inhospitably and the Ngolok rode higher up the river to cross.

Beyond the Machu, there are no more sod-cairns and the road is marked only by the droppings of caravans. After crossing a low range, where we found dozens of wild yak skulls, we lost the road on May 5. It speaks very well for Jimmy and Bozong that they did not press me to return at this stage, for our prospects were far from cheerful. Hsiao Lo, my mule, had to be abandoned on May 6, all but a few cupfuls of our staple, barley flour, was exhausted, and we were "feasting" on wild ass flesh.

On May 7 we picked up the road again and shot two bears. They were evidently just out of hibernation, in superb pelage, and very fat. The mean diurnal temperatures were between 32° and 45° F., falling to between 18° and 25° F. at night. The steppes were almost barren of life, including ravens and birds of prey, with the exception of a marshy steppe crossed on April 30, thirty miles south-southwest of the Machu where Indian barheaded geese, ruddy sheldrakes, and terns, were congregated in some numbers.

On May 9 we again lost the track just east of the Tossun Nor Lake as we learned when we were found on May 11 by a merchant caravan bound like us for Sining. On these huge steppes one loses the road in the following manner: Caravans habitually camp on the same general site at the edge of a steppe but the site may be extended to a mile in length by the quest for fresher pasture. The caravaneers know the road by heart and in the morning simply steer an approximate course toward some distant focal point where the main road follows the easiest features of a mountain range. Only by making a huge circle could we be sure of cutting the main road (to be recognized as a wide enough band of yak droppings) and on the last occasion we were fooled for an entire day by a Ngolok road leading too far to the eastward. A blizzard then descended, covering the tell-tale yak chips.

We were able to purchase supplies from the merchants and we travelled with them for four days. At daybreak of May 14 from an encampment named Jitsida near the Lake Beri-toun-tso, I had a glorious view of the great snow peak Amnyi Machen probably seventy-five miles away.

On May 15 we crossed the Dsasola, (elev. 14,600 ft.) into a lower country far more advanced in season than the steppes of Machuka behind us. On May 16 we saw the first habitations, the tents of the shy Banak nomads, and on May 17 passed the Mohammedan outpost of Da Ho Pa, where I was first recognized as a foreigner but escaped questioning.

From May 17 to May 21 we crossed an almost waterless Mongolian plateau country, reaching the hamlet of Chabeha (Cha-P'u-Cha) on May 21. On May 23 we passed within a few miles of the southern end of Lake Kokonor and on the 24th, after a 37-day journey, reached Tangkar where I was most hospitably received by my old friends Mr. and Mrs. Marcel Urech of the China Inland Mission, who had been our hosts at Tachienlu in 1931.

I left Tangkar, having made arrangements with Mr. Urech for another caravan, with which we planned to travel together as far as Barun Tsaidam, leaving in the end of June when I should have returned. From Barun I planned to travel southward to meet Schäfer and Duncan.

At Sining I obtained the promise of General Ma Pu-fang that the expedition be permitted to travel and hunt in the western Kokonor and northern Tibet with the understanding that the party return to China via Jyekundo and Szechuan Province. This I had long since determined in my mind was the only course open to us in the face of the sheer physical difficulties of travel in northern Kokonor, to say nothing of official opposition.

It was necessary for me to return to Shanghai for refinancing and re-outfitting with film, ammunition, and general equipment. From Lanchow, the Capital of Kansu Province, where I was the guest of Mr. Bell and the other very kind members of the China Inland Mission, I flew on a ship of the Eurasia Line via Sian-Fu, Chengchow, and Nanking to Shanghai.

At Nanking I approached our Consulate-General and I learned, to my dismay, that a special permit would be necessary to visit the Kokonor. Tentative agreement was given by the Foreign Office with the stipulation that the authorities of Kokonor approve such a permit. The recent movements of the Communist armies around Sungpan toward Kokonor were given as an objection, as I feared they would be and the permit was not granted. Accordingly with a 70-day trip into Jyekundo via Szechuan as an alternative, active participation in the expedition was over for me. I wirelessly to Philadelphia and on July 10 my wife joined me in Shanghai.

The Work of the Expedition from April 15 Until October 15, 1935

Following my departure from Chinto (Camp 77) Duncan was able to conclude an agreement with the Mohammedan military, whereby the party proceeded to Drechu Gomba (Camp 79). This lamasery which Schäfer subsequently used as a base for intensive collecting lies at the edge of the winding Dsachu Steppe. Rolling hills of scarce, tufted grass and low, granite ranges roll north and south from the edge of the plain to the Yangtze watershed and the height of land south of the Machu or Upper Yellow River. Both big-horned and blue sheep range the mountains; steppe bears are plentiful. The plain and the adjoining bluffs are the breeding place of thousands of cranes, Indian bar-headed geese, ruddy sheldrake, and other waterfowl. Hunting out from Drechu Gomba, Schäfer and Duncan collected a series of *Ovis a. hodgsoni* in the mountains to the westward (Camps 80-83). This trip was terminated by a blizzard. The sheep were found to be already commencing their moult (April 20-May 3). In the environs of Drechu Gomba, Schäfer made large bird collections (Plate 19).

Returning to Jyekundo, on about May 8 Schäfer set out south-south-westward into Tibet, crossed the Gurla Pass and on May 14 and May 16 from Camp 90 in the Mekong drainage found and killed specimens of M'Neill's deer, including the all important stags never before collected. Into the Mekong watershed toward Chiamdo he collected also a specimen

of the rare eared pheasant *C. crossoptilon drouyni*, returning to Jyekundo on May 19. On May 22 he set out once more southwestward again crossing the Gurla and collecting specimens of M'Neill's deer and bear, returning to Jyekundo on June 1. These two trips represent Camps 86-97.

In the meantime Duncan had remained in Jyekundo attending to our finances and continuing to press for permission to penetrate into the wild yak country. At this time, it was granted me by Gen. Ma Pu-fang in Sining that the expedition be permitted to make a journey into that territory on condition that the party return to China via Szechuan. This permission was transmitted to Jyekundo by the military wireless and communicated to Duncan on June 1. At the same time, a Chinese gentleman of influence, Colonel C. C. Ku, arrived in Jyekundo from Sining investigating for the Department of Agriculture the grazing lands and livestock of Kokonor. He befriended us in many ways, standing sponsor for our social and financial credit. It was arranged that Schäfer should be allowed a journey onto the Chang Tang, the Great Northern plain of Tibet, and that Duncan should remain at Jyekundo as a hostage to our promise and as collateral on various debts for which money from Tachienlu had not yet arrived.

In the brushy valleys around Jyekundo Schäfer collected a series of eared pheasants intermediate between *Crossoptilon c. crossoptilon* and *C. harmani* which Rodolphe de Schauensee has done me the honor of naming *Crossoptilon c. dolani*.

On June 6 Schäfer left Jyekundo for the Chang Tang travelling on our former course as far as Drechu Gomba. It is necessary to bear in mind when following our route by camp numbers on the accompanying map that identical camps were used for different stages of different journeys, and that, for reasons of identification and space, we have not changed the original number of any camp. The next number in logical sequence appears at the next fresh camp.

Schäfer's journey in search of wild yak and chiru was attended by great difficulties of transport and personnel. He lost many yak and several riding animals from exhaustion and in quicksands, at unknown river crossings, etc. His men were a constant problem, rebelling with each day's journey against further travel into the drear and disheartening wastes of the Chang Tang.

This is a land of high steppes similar to those crossed by me en route to Sining and described above. The level of the Chang Tang steppes varies between 13,800 and 16,000 ft. with mountain ranges up to 18,000 between the steppes. Snow is the order of summer, and high river-levels, mud, and quicksands.

Schäfer travelled first north-northwestward to the Karma Tang, the source-land of the Machu or upper Yellow River and, failing to find yak there where they formerly abounded, continued his journey northward toward the Borhan Bhot, the range separating the Chang Tang from Tsaidam. From there he cut southwestward across tremendously high country finding and killing yak (*Poephagus grunniens mutus*) at Camp 117 or thereabouts in the last days of June.

The chiru still continued elusive and he travelled westward in the face of mounting rebellion, crossing what he believes to have been the Chumar branch of the Upper Yangtze, securing chiru (*Pantholops hodgsoni*) finally at his westernmost camp (Camp 124) on July 5 to the southeast of the Kukushili range (Plate 20). He returned to Jyekundo as rapidly as his exhausted animals would permit, having collected yak, chiru, white-lipped deer (high above any timber but dwarf rhododendron and willow), and Hodgson's sheep, reaching Jyekundo on August 3 or 4 (Camps 102-134).

Duncan meantime had returned to Tachienlu to arrange finances and transport of the collections out. About August 7, Schäfer set out for Seshu in Szechuan, where he made systematic collections of birds and returned again to Jyekundo, leaving there for the last time about August 23 with all the collections in hand. At Seshu he sent the caravan on to Tachienlu via Kanze and Dawo, southward, stopping, himself, at Dzogchen Gomba (September 4-8). In the mountains to the southwest of the lamasary, in high rhododendron growth, Schäfer found a herd of M'Neill's deer and collected several males. In the beginning of September he found the large stags with velvet stripping off and clean horn beneath. The younger stags were still carrying full velvet. They are under the protection of the Abbot of Dzogchen Gomba. He collected there also a buck and roe of *Capreolus capreolus bedfordi*, encountered and collected by us in 1931, west and northwest of Sungpan, on both occasions establishing a southerly record.

Schäfer and Duncan met in Dzogchen on September 7 and Schäfer proceeded on to Rongbatsa, Kanze and Dawo, where he spent a number of days, reaching Tachienlu on September 25, Duncan following with the caravan, arriving on September 27. Duncan at once set about preparing the caravan for the journey to Yachow, while Schäfer made a final collecting trip to Waszekou.

From Tachienlu, where they bade a fond farewell to our kind hosts and friends Mr. and Mrs. Bob Cunningham, they returned down the road to Yachow, which we had ascended in August 1934, and on October 22nd I met them at Yachow, where, after repacking and arranging our cases of specimens and what was left of our equipment in the compound of our old friend Miss Shurtlieff, we took a raft down the Ya River to Kiating, a junk down the Tung River to Suifu, and a small motor ship down the Yangtze to Chungking.

In Chungking, our passports for the interior having expired and the Maritime Customs having received no instructions concerning our collections, we were delayed interminably although our kind hosts Mr. J. R. Schwer of the Chungking Ice Co. and Mr. and Mrs. Morisoff, as well as other good friends, did much toward making our stay a pleasant one. Flying back to Shanghai and Nanking, I secured the necessary releases and Schäfer and Duncan, who had remained to care for the collections, arrived in Shanghai on a Yangtze River steamer on November 20.

In Shanghai we concluded formalities with the Academia Sinica and the Metropolitan Museum, whose authorities secured release by the customs of our collections and equipment for shipment to Philadelphia. Duncan sailed from Shanghai for the United States just before Christmas, 1935. Schäfer accompanied Mrs. Dolan and myself to Philadelphia where he will long be remembered by his many enthusiastic friends.

GENERAL RESULTS

The collections secured can be summarized as follows:

Mammals: 310 specimens, large and small.

Birds: 2615 specimens.

Mollusks: 2600 specimens of which about 150 represent wet preparations.

The expedition was in the field of work some fourteen months and in view of this extended period the collections do not seem large. Several factors, one of them not generally present in modern exploration, were instrumental in restricting the size of the collections.

In the first place every step of the three thousand odd miles traversed by the party in the actual field of collecting was covered afoot or on horse-back. Collecting and preparation work during periods of laborious travel—to say nothing of the physical obstacles to collecting in Tibet between the months of October and June—are naturally difficult. Detailed study of the reports here presented will quickly show to what extent we were dependent upon prolonged halts for systematic collections. Such localities as Tachienlu, Litang, Batang, Jyekundo, Drechu Gomba, and Dawo, localities in which we stayed for periods of many days or weeks will recur on every other page of the three systematic reports to follow.

Another factor influencing the size of our collections was my conviction that the large mammals, many of them on the road to extinction even in that secluded land, were the most important objectives. That many will disagree is natural. Nevertheless, we could have had no more productive rule from the standpoint of large mammals, for of this group, only the leopard and snow-leopard (of which we had been able to purchase trade skins in 1931) eluded us. We were successful in collecting the mammal

fauna of the high Tibetan steppes. We secured and established the hitherto unknown eastern ranges of the large Tibetan stags, *Cervus albirostris* and *Cervus macneilli*. Of the latter we collected the first males.

The bird collection is outstanding in fine series of rarities and is a credit even to the superior collecting talent of Dr. Ernst Schäfer. The collection includes five new races, previously published in the Proceedings of this Academy (1937).

For the mollusk collections, we can lay no claim to completeness. The richest life-zone for this group of animals in Hsifan, Khams, and Chinghai, due perhaps to the high level of the forests and the cold climate generally prevailing there, is in the deep arid trenches of the great rivers and their tributaries which as a rule did not hold the expedition except as corridors of travel. However, extensive collections were made in the gorge of the Upper Yangtze River below Batang.

As to the value of the exploratory work done by the expedition, the field of Khams, and lower Chinghai, although traversed repeatedly by geographical explorers had been only partially explored by zoologists. Walter Zappey had penetrated no further westward than Litang, Kozlov had come down from the north to Jyekundo. Dr. Hugo Weigold, as ornithologist for The Stötzner Expedition had worked as far north as Derge but had then turned back eastward to Kanze passing along the southern edge of the mountains whose northern slopes would have shown him the great steppes of the Upper Yalung with their high Tibetan fauna. On these steppes in the triangle formed by Derge, Jyekundo and Kanze, with the Upper Yalung as hypotenuse, we established many new southern and eastern records for Tibetan life-forms.

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I wish to tender sincere thanks to the following persons whose names do not appear in the above text, but whose kindness and cooperation not only contributed materially to the success of the expedition but also added greatly to the enjoyment of our visit to China: Mr. and Mrs. Leonard Everett, Mr. and Mrs. Heinrich Höne, Mr. and Mrs. Clarence Meyer, Mr. and Mrs. William T. Hunt, Mrs. Harold Ogden, Mrs. Jack Young, Mr. Kermit Roosevelt, Mr. Thomas Tsai, and Mr. William Sipprell.

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CAMPS AND LOCALITIES OF THE SECOND DOLAN EXPEDITION TO WESTERN
CHINA AND EASTERN TIBET

The numbers given for the camps are those shown on the accompanying map in their respective positions.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Sept.	7.	1. TACHIENLU (elev. 8900 ft.).	Situated in a deep valley. Barley plantations, poplar, birch, prickly oak, rhododendrons.
	8.	2. Cheto	Outer perimeter of Hsifan: rhododendrons, conifers.
	9.	Pass; Cheto La, elev. 14,200 ft.	Boundary between Hsifan and Kham faunas.
	9.	3. Tizu	Khams: rolling grassland, dwarf rhododendron, willows, larches. Many partridges.
	10.	4. Chorten	Khams: Anya Valley, sown to barley. Grasslands, larches, patches of conifers. Many marmots.
11, 12.	5.	Tunggnolo	Khams: Barley plantations, poplar, birch, prickly oak (<i>Quercus ilex</i>). Eared pheasants.
	13.	Pass: Gazhi La, elev. 14,800 ft.	A double pass with a saddle representing the first finger of Kham Steppe.
	13.	6. Oroshe	Dense Kham Forest: spruce, fir, prickly oak, many shrubs. Musk deer, serow, sambhar, other stags(?).
	14.	7. Shawa Rimba	Lower Kham Forest: prickly oak, golden oak, birch, poplar, pine, barley fields. Sambhar, parrots.
15, 16.	8.	Hokow (on the Yalung, elev. 9400 ft.).	Deep, arid river-trench: thorny shrubs. Goral, Yunnan birds (come up the warm river-corridor).
	17.	9. Nyachuka (on the opposite bank and incidentally the Tibetan name for the valley of the Yalung).	
	18.	10. Magidrong	Upper Kham Forest: conifers, prickly oak, rhododendron. Musk deer, serow.
	19.	Pass: Rama La, elev. 15,400 ft.,	giving onto the easternmost projection of the central Kham Steppe.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Sept.	19.	11. Melamgong (elev. 14,000 ft.).	Kham Steppe: a winding plateau of high grassland, beset by forested valleys. Gazelles.
	20.	12. Hsignolo	Fine Kham Forest: spruce, birch, fir, etc., invading the Kham Steppe along the valley of Hsignolo, in which flows a tributary of the Yalung. Stags.
	21.	13. Changkako	Upper Kham Forest: coniferous and juniperous; shrubs, grassland. Musk deer, gazelles.
	22.	14. Tangkama	Kham Steppe: grassland, dwarf rhododendron. Larks, gazelles, lammergeiers. Nomad encampment.
	23.	15. Horchu	Kham Steppe: grassland. Ruddy sheldrakes, ravens, gazelles.
	24.	16. LITANG (elev. 13,800 ft.).	Kham Steppe, grassland, dwarf rhododendron. Gazelles, wolves, cranes, storks, many ruddy sheldrakes, larks, pipits, ravens, lammergeiers.
	28.	17. Bemah	Southeastern edge of Litang Steppe.
	29, 30.	18. Tralitsong (Malashi) ..	Upper Kham Forest: conifers, rhododendron. Musk deer, white-lipped deer; M'Neill's deer(?).
Oct.	1-3.	19. Din Dunko (Malashi) ..	Splendid Kham Forest: spruce, fir, rhododendron, grassy glades. Mammals as at Camp 18.
	4.	20. Rihchako (Malashi) ..	Similar to Camp 19.
	5-14.	21. (16) Litang	Characterized as Camp 16.
	15.	22. Chukundo	Kham Steppe in the valley of the Litang River.
	16, 17.	23. Bonya Tang (plain) ...	Wide steppe of the Litang River. Encampments of the Washi nomads.
	18.	24. Upper Bonya Tang	Elev. 14,200 ft. Southwesterly corner of the Litang Steppe. Many gazelles.
	19.	25. Below Shari La	Alpine meadows, junipers, dwarf rhododendron.
	20.	Pass: Shari La (Gari La), elev. 15,900 ft.	

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Oct.	20. 26.	Shari Ngotso	Upper Kham Forest: cedars, dwarf rhododendron. Blue sheep, musk deer; stags(?).
	21. 27.	Upper Gemoh	Grassland, Kham Forest: conifers, cedars. Wild dog, musk deer.
	22.	Pass: Tsong Ben La. elev. 16,500 ft.	
	22. 28.	Above Bon Tramoh . . .	Dwarf rhododendron, junipers, willows. Just above rich, coniferous forest. Blue sheep, musk deer.
	23. 29.	Mili Ting	Lower Kham Forest: Poplar, pine, prickly oak, birch, plantations. Sambhar.
Oct.	24. 30.	BATANG (elev. 9000 ft.).	Deep, arid valley: barberry, plums, roses, cotoneaster. Goral, Yunnan birds.
		Leh and Drupalong on the	Yangtze River below Batang at elev. circa 8000 ft. are similar life-zones with the addition of stipa grass slopes from the river up to the lower timberline at elev. 9400 ft.
until			
Jan.	19.	Batang Mts. (elev. 8000-17,000 ft.).	
	20. 31. (29)	Mili Ting	Characterized as Camp 29.
	21 32.	Above Bon Tramoh . . .	Upper Kham Forest: sparse coniferous woods, junipers, willows. Blue sheep, lynx.
	22.	Pass: Tsong Ben La, elev. 16,500 ft.	
	22. 33.	Upper Gemoh	Characterized as Camp 27.
	23. 34.	Melundrato	Characterized as Camp 26. Cedar forest.
	24.	Pass: Shari La, elev, 15,900 ft.	
	24. 35.	Below Shari La	Characterized as Camp 25. Partridges, rock-pigeons, ruddy sheldrake, wolves.
	25. 36.	Upper Bonya Tang . . .	Kham Steppe: many wolves and gazelles.
	26. 37.	Head of the Litang River (western branch).	Kham Steppe.
	27.	Grassland Pass: 16,000 ft.	
	27. 38.	Upper Lingkashi	Upper Kham Forest: grassland, dwarf rhododendron, juniper, sandthorn (<i>Acacia</i>). Encampment.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Jan.	28. 39.	Meloumba	Upper Kham Forest: grassland, cedars. Nocturnal temperature —17 degrees Fahrenheit.
	29.	Pass: 16,000 ft. elev.	
	29. 40.	Deep Valley	Kham Forest: conifers, cedars, rhododendrons.
	30.	Pass elev. 16,300 ft.	
	30. 41.	Sama (elev. 11,500 ft.)	Lower Kham Forest: prickly oak, poplar, birch, barley cultivation.
	31. 42.	Sho Du Tang (elev. 11,000 ft.)	Lower Kham Forest: prickly oak. Sambhar, tufted deer, <i>Grandala</i> .
Feb.	1. 43.	Denna (Dene) Tang (elev. 10,300 ft.)	Lower Kham Forest: prickly oak, brush, cultivation.
	2. 44.	Sho Tang	Heavy Kham Forest: spruce, rhododendron. Alpine meadows.
	3.	Pass: Me La, elev. 14,400 ft.	
	3. 45.	Below Pass	Coniferous Kham Forest. Many eared pheasants.
	4-6. 46.	BEYÜ (PEHYUL) (elev. 10,700 ft.)	Brush zone. Coniferous forest above.
	7.	Pass: Nyozo (Mizo) La, elev. 16,300 ft.	
	7.	Pass: Jyacho La, elev. 15,000 ft.	
	7. 47.	Gartoh Gomba (elev. 13,400 ft.)	Willows; coniferous forest below. Many lammergeiers.
	8. 48.	Horbo (elev. 10,400 ft.)	Brush zone just below coniferous forest. Plantations.
	9. 49.	Sotong (on the Yangtze)	Arid brush zone: Barberry, plums. Goral, Tufted deer. Tree-line of poplar and birch much lower in relation to the river than at Batang.
	10. 50.	Deshu (on the Yangtze)	Locality similar to Camp 49.
	11. 51.	Derge Jonrah	Arid valley: barberry, plums, roses. Goral.
	12-16. 52.	Derge (Dege) Göñchen (elev. 10,800 ft.)	Locality similar in character to Camp 51. Coniferous forests above.
	17. 53.	Kolondo (elev. 11,700 ft.)	Coniferous and juniperous Kham Forest.
	18. 54.	Below Pass	Grassland, coniferous and juniperous forest. Many water ouls.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Feb.	19.	Pass: elev. 14,900 ft.	
	19.	55. Marung (12,710 ft. elev.)	Coniferous and heavy juniperous forest. Many white, eared and blood pheasants.
	20.	56. Göze Gomba (elev. 12,300 ft.)	Open grassland and brush.
	21.	57. Nojeling (Nojili) Gomba (elev. 12,800 ft.)	Grassland, willows.
	22.	58. Denko (on the Yangtze, elev. 11,200 ft.)	Arid, sparse brush zone. Cedars and willows above.
	23.	59. Buho	Narrow rocky gorge. Junipers, willows.
	24.	Pass: Dsi La, elev. 15,800 ft.	Drops down to the first country of high Tibetan character. Fig. 2.
	24.	60. Da Dsi (elev. 14,800 ft.)	Bare bleak steppe (see Map: "Chinghai Steppe"). Wild ass or kiang, <i>Ovis ammon hodgsoni</i> .
Feb. until Mar.	25.	61. SESHU (Ju Gomba, elev. 13,900 ft.)	High steppe: kiang, goat, wolves, steppe foxes, pikas, steppe buzzards and steppe falcons.
	8.		
	8.	62. Waterh (on the Yalung, elev. 13,600 ft.)	Tibetan Steppe: of similar character to Camp 61. Many waterfowl.
	9, 10.	63. Getze Gongma	Tibetan Steppe. Encampments.
	11.	64. Hachu Nandra	Tibetan Steppe. Encampments.
	12.	65. Minoh Lungchen	Tibetan Steppe: small, steep mountains with sparse willow on the slopes. <i>Ovis ammon hodgsoni</i> .
	13.	66. Hachu (elev. 15,000 ft.)	High, bare tableland, almost without vegetation. Former range of wild yak.
	14.	67.	Tibetan Steppe: at the edge of a huge plain, pasture for hundreds of wild ass.
	15.	62. Waterh	Characterized as Camp 62.
16-19.	61.	Seshu (Ju Gomba) ...	Characterized as Camp 61.
	19.	68. Seshu Gomba	Tibetan Steppe.
	20.	69. Ten miles west of Seshu Gomba.	Tibetan Steppe. Many waterfowl: barheaded geese, mallards, scaup, golden-eye.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
Mar.	21.	Pass: Ngamba La, elev. 14,700 ft.	Leads back into the main Yangtze drainage.
	21.	70. Sheru(g) Gomba	Juniperous wood and willows.
	22.	71. Drebumdo (on the Yangtze)	Brush zone. Many partridges.
	22.	Yangtze River Crossing, elev. 11,700 ft.	
Mar. until	23.	72. JYEKUNDO (elev. 12,300 ft.)	Arid, brush zone: cultivation, mountains grass-covered.
Apr.	12.		Willows, junipers, other shrubs in the small valleys.
	12.	73. Lanyipa	High mountain-saddle: scattered willows.
	13.	74. Sacha Sumdo	Head of Tongbumdo valley. Brush zone.
	14.	75. Ts'in Da	Arid gorge of the Yangtze: brush.
	15.	76. Lamdo	Arid gorge of the Yangtze: brush.
	16.	77. Below Pass	Brush zone: willows. Tibetan snowcock.
	17.	78. Beyond Chinto	Grassland, willows.
(Beyond Camp 78 all data are based on the observations of Dr. Schäfer and Mr. Duncan.)			
Apr. 18-20.	79.	Drechu Gomba (elev. 13,800 ft)	Tibetan Steppe: the plain of the Upper Yalung or Dsachu. Breeding waterfowl, cranes etc. Bears, wolves, foxes, pikas.
Apr. to	20.	80-84.	Tibetan Steppe: rolling, bare mountains. <i>Ovis ammon hodgsoni</i> , steppe bears, pikas.
May	3.		
		85. Near Lamdo on the Yangtze.	Brush zone.
		72. Jyekundo	<i>Crossoptilon crossoptilon dolani</i> .
May	9-19.	86-97. Two trips toward Chamdo.	High Mountains of the Yangtze-Mekong watershed (Gur La, pass). Kham Forest and brush zone. McNeill's deer in high, dwarf rhododendron cover. Kham birds. <i>Crossoptilon crossoptilon drouynii</i> .
May to	22.		
June	1.		
	1.	72. Jyekundo	
		98-100.	Tibetan Steppe and brush zone.
	7.	72. Jyekundo.	
	8.	76. Lamdo.	
	10.	79. Drechu Gomba.	

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
June	10-13. 102-104.	.....	Tibetan Steppe: along the Dsachu or Upper Yalung. Schäfer's lesser Sandplover.
	13, 14. 105-106.	.....	Sources of the Dsachu (elev. 14,500 ft.).
	15, 16. 107-108	.....	Tibetan Steppe and bare mountains. Golden plover.
	17-21. 109-113.	.....	Source-lands of the Machu (Yellow River), including the Karma Tang (plain). Within the present range of wild yak. General elev. circa 14,200 ft.
	114-116.	.....	South of the Borhan Bhota Range. Tibetan Steppe.
June	29. 117.	.....	Tibetan Steppe: wild yak.
July	1.	.....	
	2. 118.	.....	Tibetan Steppe. Chumar branch of the Upper Yangtze. Wild yak and chiru.
	3. 119	.....	Drechu branch of the Upper Yangtze. Similar character.
	4-16. 120-127	.....	Tibetan Steppe: wild yak, chiru.
July	17. 128.	.....	Tibetan Steppe.
	18.	.....	
	22. 132.	.....	Tibetan Steppe.
	23.	.....	
	28? 79.	Drechu Gomba.	
Aug.	3-7. 72.	Jyekundo.	
	8. 135.	On the Yangtze	Brush zone.
	10. 136.	Near Sheru Gomba	Brush zone.
	11. 137.	Above Seshu Gomba.	Tibetan Steppe. Using former camps (and numbers) Schäfer visited Seshu and returned to Jyekundo.
	138.	Near Jyekundo on the Yangtze.	Brush zone. Leaving Jyekundo about August 25, Schäfer returned again to Seshu.
	30. 139.	East of Seshu	Tibetan Steppe.
	31. 140-144.	.....	Southeasterly prolongation of Chingai-Tibetan Steppe along the Yalung.
Sept.	4. 5-8. 145.	Dzogchen Gomba (elev. 13,800 ft.)	Tibetan Steppe to the north. Kham Forest on the mountains to the southwest. M'Neill's deer, roedeer.

<i>Date</i>	<i>Camp</i>	<i>Locality</i>	<i>Biota</i>
		Pass: Muri La, elev. 15,950 feet.	
	147.	Yilung (Jülung)	Wide valley of the Yilung, steppe-like in character Splendid Kham Forest on the mountains.
Sept.	12.	148. Rongbatsa (elev. 11,600 ft.)	Southwesterly indentation of the Yalung plain. Under cultivation. Forests to the south.
		149-152.	Rolling Kham steppes and in the valley of the Shechu, fine, Kham Forest.
Sept.	17-22.	153. Dawo (elev. 10,200 ft.)	Grasslands and Kham Forest.
		154-156.	Rolling Kham Forest and Steppe.
		Pass: Cheto La, elev. 14,200 ft.	Boundary between Kham and Hsifan faunas.
Sept.	26.	1. Tachienlu.	
Oct.	5-15.	Waszekou (elev. 6,000 ft.?)	

ZOOLOGICAL RESULTS OF THE SECOND DOLAN EXPEDITION TO
WESTERN CHINA AND EASTERN TIBET, 1934-1936.

PART II, — BIRDS

BY ERNST SCHÄFER ¹ AND RODOLPHE MEYER DE SCHAUENSEE ²

The present report presents the results of two distinct and independent studies of this very extensive series. The bird collection, on its receipt in Philadelphia, was divided roughly into two parts on geographic or size factors, and while Mr. de Schauensee's study was done in Philadelphia, that of Dr. Schäfer was completed in Berlin. Subsequently, after the receipt of both manuscripts in order to facilitate the presentation of results which frequently overlap, it seemed advisable to combine the two independent studies in a single report. This has been done, but the personal angle has been preserved by following the entries and comments under the species in each case by the initials of the individual author responsible for them.

In all cases references are given as in the separate manuscripts and original name combinations are filled out only when and as originally given.

For detailed information on localities, the student is referred to Part I of these reports, in which Mr. Dolan has presented a full list of all the Expedition's collecting stations.³ [Editor.]

PHALACROCORACIDAE

Phalacrocorax carbo sinensis (Shaw and Nod.)

Pelecanus sinensis Shaw and Nodder, Nat. Misc., XIII, pl. 529, text, 1801. (China.)

Two females secured at Batang (Camp 30) in August and October. (R. M. S.)

ARDEIDAE

Ardea cinerea jouyi Clark.

Ardea cinerea jouyi Clark, Proc. U.S. Nat. Mus., XXXII, p. 468, 1907. (Seoul, Korea.)

Two adult and two juvenal females of this wide-spread heron were secured at Yachow, the former in October and the latter in August. (R. M. S.)

Ardeola bacchus (Bp.)

Buphus bacchus Bonaparte, Consp. Gen. Av., II, p. 127, 1855. (Malay Pen.)

One male in breeding plumage from Chungchow taken in August; two males in winter plumage, Tatsienlu, October 3, and two immature birds

¹ Zoological Museum, Berlin.

² Curator of Birds, Academy of Natural Sciences of Philadelphia.

³ This volume of these Proceedings, pp. 159-184, pls. 12-20 and route map.

taken, one at Chengtu July 30, the other at Hokow, September 19 (Camp 8). (R. M. S.)

Egretta garzetta garzetta (L.)

Ardea garzetta Linnaeus, Syst. Nat., ed. XII, 1, p. 237, 1766. (Orient ex Brisson-Malalbergo N. E. Italy, Grant., 1933.)

A female secured in August at Yachow. (R. M. S.)

CICONIIDAE

Ciconia nigra (L.)

Ardea nigra Linnaeus, Syst. Nat., ed. X, 1, p. 142, 1758. (Sweden.)

An unsexed bird in juvenal plumage was secured at Litang (Camp 16) in October. (R. M. S.)

ANATIDAE

Eulabeia indica (Lath.)

Anas indica, Latham, Ind. Orn., II, p. 839, 1790. (India, Tibet.)

A splendid series of birds in every stage of plumage from nestlings to adults, taken at Camp 62 in March, Camp 102 in June, and Camp 131 in July. The nestlings were collected at Camp 102. (R. M. S.)

Casarca ferruginea (Pall.)

Anas ferruginea Pallas, in Vroeg's Cat., Adumbr., p. 5, 1764. (Tartary.)

A large series of this duck was secured at Jyekundo in June, and Litang in October. Two nestlings in down were collected at Jyekundo in June. (R. M. S.)

Anas platyrhynchos platyrhynchos L.

Anas platyrhynchos Linnaeus, Syst. Nat., ed. X, 1, p. 125, 1758. (Sweden.)

A small number of Mallards were secured at Batang, Derge and Jyekundo in February, April and November. (R. M. S.)

Anas crecca crecca L.

Anas crecca Linnaeus, Syst. Nat., ed. X, 1, p. 125, 1758. (Sweden.)

The Green-winged Teal is represented in the collection by birds from Leh and Camps 14, 56, and 78 taken during February, April, and September. (R. M. S.)

Anas acuta acuta L.

Anas acuta Linnaeus, Syst. Nat., ed. X, 1, p. 126, 1758. (Sweden.)

A pair from Camp 62 in March. (R. M. S.)

Nyroca fuligula (L.)

Anas fuligula Linnaeus, Syst. Nat., ed. X, 1, p. 128. 1758. (Sweden.)

A male from a few miles east of Seshu taken in March. (R. M. S.)

Nyroca nyroca (Gülden.)

Anas nyroca Güldenstädt, Nov. Comm. Sci. Petropol., XIV, 1, p. 403, 1769. (—regionibus Tanaicentibus.)

A female from Camp 91 in May. (R. M. S.)

Bucephala clangula clangula (L.)

Anas clangula Linnaeus, Syst. Nat. ed., X, 1, p. 125, 1758. (Sweden.)

A male from Seshu, taken in March. (R. M. S.)

Mergus merganser merganser L.

Mergus merganser Linnaeus, Syst. Nat., ed. X, 1, p. 129, 1758. (Sweden.)

A large series from Beyü (Pehyul), Derge, near Litang, and Camps 15, 23, and 62 taken in February, March, September, and October.

The wings of the males range between 280 mm. and 300 mm., the females between 248 mm. and 275 mm. Some of the females are very small and should perhaps be referred to *M. m. orientalis*. (R. M. S.)

ACCIPITRIDAE**Milvus lineatus lineatus** (J. E. Gray).

Haliastur lineatus, J. E. Gray, in Hardwicke, Ill. Ind. Zool., 1, pt. 8, p. 1, pl. 18. 1831. (China.)

This kite was secured at Litang, Batang, and Jyekundo during March and October. (R. M. S.)

Accipiter gentilis schvedowi (Menzbier).

Astur palumbarius schvedowi Menzbier, Orn. Geogr. Eur. Russl., (in Mém. Sc. Univers. Imp. Moscou, Hist. Nat.), p. 439, 1882. (Transbaikalia.)

A bird with no data, and another in immature plumage secured at Marung (Camp 55) in February. Steinbacher, who has examined series of this bird, says that *khamensis* Bianchi is not separable. (R. M. S.)

Accipiter nisus nisosimilis (Tick.) *

Falco nisosimilis Tickell, Journ. As. Soc. Bengal, II, p. 571, 1833. (Marcha, Borabhum, India.)

A small series secured at Derge, and Batang during January, February and December. (R. M. S.)

Buteo hemilasius Temm. and Schl.

Buteo hemilasius Temminck and Schlegel, in Siebold, Fauna Jap., Aves, p. 18, pl. 7, 1844 (1845). (Japan.)

A small series of adults, one fledgling and two nestlings were secured at Camps 62, 103, 132 and 133.

The two downy young, identified in the field by Schäfer, are sandy grayish above, below creamy white with a pectoral band of pale sandy buff. Lores creamy white. The upper mandible is black, the lower brownish horn in the skin. They were taken June 12. (R. M. S.)

Buteo burmanicus burmanicus Hume.

Buteo burmanicus Hume, Stray Feathers, III, p. 30, 1875. (Thayetmyo, Upper Pegu.)

A series from Leh, Dawo, Derge, Batang, and Camp 45 taken during February, September, November and December.

This series of seven birds is darker than two birds from northeast China and should perhaps be referred to *B. b. saturatus* Portenko. We have no Burmese material however to compare them with. (R. M. S.)

***Aquila chrysaëtos daphanea* Severtzov.**

Aquila daphanea Severtzov, Nouv. Mém. Soc. Imp. Nat. Moscou, XV, livr. 5, p. 190, 1888. (Russian Turkestan, Mongolia, Himalayas, Transbaikalia, and Ala Shan Mountains.)

Of this splendid eagle there are one male and two females from Batang, Camps 37 and 139 taken during January, August and December.

The largest bird has a wing of 713 mm. The tail of this bird is white at the base, then grey, and the tips of the central tail feathers dark brown for about 110 mm. The dark brown tip increases in extent on each succeeding tail feather until on the outermost it occupies 165 mm.

The other two birds have a certain amount of white irregularly disposed on the tail feathers not presenting a regular pattern as in the first mentioned specimen. (R. M. S.)

***Aquila nipalensis nipalensis* (Hodgs.)**

Circaëtus nipalensis Hodgson, Asiatic Researches, XVIII, pt. 2, p. 13, pl. 1, 1833. (Nepal.)

Two males and a female were collected at Camp 62 on March 12. A fourth bird with no data is also in the collection. (R. M. S.)

***Haliaëtus leucoryphus* (Pall.)**

Aquila leucorypha Pallas, Reise Versch. Prov. Russ. Reichs, I, p. 454, 1771. (Lower Ural River.)

A good series of this eagle was secured at the following Camps: 71, 91, and 139 during May and September. (R. M. S.)

***Aegypius monachus* (L.)**

Vultur monachus Linnaeus, Syst. Nat., ed. XII, 1, p. 122, 1766. (Arabia.)

One male was collected at Camp 79 during April. (R. M. S.)

***Gyps himalayensis* Hume.**

Gyps himalayensis Hume, Rough Notes, pp. 12, 15, 1869. (Himalayas from Kabul to Bhutan.)

A pair from Litang in September. (R. M. S.)

***Gypaëtus barbatus aureus* (Hablizl).**

Vultur aureus Hablizl, Neue Nord. Beytr., IV, p. 64, 1783. (Prov. of Gilan, N. Persia.)

An adult pair of Lammergiere was secured at Litang in September. Three juvenal females are also in the collection, one from Camp 120, July, one from Litang in September, and the third from Batang in November. (R. M. S.)

***Circus cyaneus cyaneus* (L.)**

Falco cyaneus Linnaeus, Syst. Nat., ed. XII, 1, p. 126. 1766. (Vicinity of London.)

An unsexed specimen taken in September between Kanze and Camp 145. (R. M. S.)

FALCONIDAE

Falco cherrug milvipes Jerd.

Falco milvipes Jerdon, Ibis, p. 240. 1871. (Umballa, India.)

A fine series of adults was secured at Camps 80 and 62 during April. Their wings measure from 360 mm. to 408 mm. (R. M. S.)

Falco columbarius insignis (Clark).

Æsolon regulus insignis Clark, Proc. U.S. Nat. Mus., XXXII, p. 470, 1907. (Fusan, Korea.)

An adult bird, marked male, (perhaps from its size a female) was secured at Litang, October 9. It is very large with a wing of 231 mm.

It is pale gray above and therefore cannot be *F. c. lymani* Bangs, under which it should fall in size. (R. M. S.)

Falco tinnunculus stegmanni (Portenko).

Cerchneis tinnunculus stegmanni Portenko, Mitt. Zool. Mus. Berl., XVII, p. 415, 1931. (Kashgaria.)

Two males and three females from Litang, Batang, Camps 14 and 101 were taken in May, June, September, October and December.

Ernst Mayr drew my attention to this form and informs me that a bird from Szechuan in the Sage collection of the American Museum belongs to it. (R. M. S.)

TETRAONIDAE

Tetrastes sewerzowi sewerzowi Przew.

Tetrastes sewerzowi Przewalski, Mongol i Strana Tangut, 2, p. 130, pl. 18, 1876. (Mountains of Kansu.)

Three males and two females from above Horbo (Camp 48), all taken in February. (R. M. S.)

PHASIANIDAE

Tetraogallus tibetanus centralis Sush.

Tetraogallus tibetanus centralis Sushkin, Bull. B. O. Club, 47, p. 37, 1936. (Tang-la Pass, Tang-la Range, central Tibet.)

A series of six males and five females from Camp 77 taken April 16.

These birds differ from a topotype of *henrici* Oustalet, by their much narrower white gular patch and more sandy upper parts. (R. M. S.)

Tetraophasis szechenyii Mad.

Tetraophasis szechenyii Madarasz, Zeitschr. f. Ges. Orn., 2, p. 50, pl. 2, 1885. (Szechuan or eastern Tibet.)

A series was secured at Malashi (Camps 18-20), Tunggnolo (Camp 5) and Batang in September, October and November. (R. M. S.)

Perdix hodgsoniae sifanica Przew.

Perdix sifanica Przewalski, Mongol i Strana Tangut, 2, p. 124, 1876. (High mountains of Kansu.)

A large series from the Cheto Pass (Camp 2) taken during October, and at Derge and Jyekundo during February, March and May.

Two juvenals were secured at Jyekundo August 20, and two half grown birds at Derge September 9.

The birds from Jyekundo and Derge average paler above, and have in some cases less wide black bands on the under surface, thus approaching *P. h. koslowi* Collin. (R. M. S.)

Bambusicola thoracica thoracica (Temm.)

Perdix thoracica Temminck, Fig. et Gall., 3, pp. 335, 723, 1815. (China.)

Two juvenals were collected in August, fifty miles east of Yachow. (R. M. S.)

Ithaginis cruentus geoffroyi J. Verr.

Ithaginis geoffroyi J. Verreaux, Bull. Soc. d' Acclimat., (2), 4, p. 706, 1867. (Mupin, Szechuan.)

A fine series of this Blood-Partridge was secured at the following localities, Tunggnolo (Camp 5), Batang, Kolondo (Camp 53), and Camps 47 and 54, during February, September and November. (R. M. S.)

Crossoptilon crossoptilon (Hodgs).

Phasianus crossoptilon Hodgson, Journ. As. Soc. Bengal, 7, p. 864, 1838. (No exact locality, probably western China.)

A pair was secured at Tunggnolo, September 20, and another pair at Malashi, October 3.

None of these birds have any white in the tail, the bases being dark gray. The mantle in all the specimens is pale gray. (R. M. S.)

Crossoptilon crossoptilon drouynii J. Verr.

Crossoptilon drouynii J. Verreaux, Nouv. Arch. Mus. Paris, 4, Bull., p. 85, pl. 3, 1868. (Mupin, Szechuan, error.)

An adult male of this rare pheasant was secured at Camp 90 in the Mekong watershed May 16. It is entirely creamy white, except for the inner webs of the primaries, which are very pale gray, the usual glossy black cap, and the tail. The tail resembles that of *C. c. crossoptilon* except that the base of all the feathers is white, most so on the outer tail feathers, and least on the central ones.

The shafts of the primaries are dark brownish black. (R. M. S.)

Crossoptilon harmani dolani de S.

Crossoptilon crossoptilon dolani de Schauensee, Proc. Acad. Nat. Sci. Philadelphia, 89, p. 339, 1937. (Jyekundo, S. Kokonor, Tibet.)

A series of seven birds of this new pheasant was collected at Jyekundo, May 19, and an additional specimen at Camp 76 on the Yangtze river, June 8, 1935. In the original description Camp 76 was erroneously placed on the Yalung.

Dolan's Pheasant can be said to be intermediate in color between *C. c. crossoptilon* and *C. h. harmani*. In fact it is a very pale replica of *harmani*, except that the back of the neck is the same color as the back, instead of almost black. (R. M. S.)

***Pucrasia macrolopha meyeri* Mad.**

Pucrasia meyeri Madarasz, Ibis, p. 145, 1886. (Central [probably southeastern] Tibet.)

Two adult males secured at Batang in December, in perfect plumage. (R. M. S.)

***Phasianus colchicus elegans* Ell.**

Phasianus elegans Elliot, Ann. and Mag. Nat. Hist., (4), 6, p. 312, 1870. (Province of Szechuan somewhere near its southwestern border.)

A good series of both sexes from Batang taken during November and December. They are in fine plumage. A juvenal female was secured at Wangmu, August 22.

One male from Batang shot November 1, was assuming adult plumage. (R. M. S.)

GRUIDAE***Grus nigricollis* Przew.**

Grus nigricollis Przewalski, Mongol i Strana Tangut, 2, p. 135, 1876. (Koko-nor.)

Four females of the Black-necked Crane were secured at Camps 23 and 79 during April and October.

An immature male was collected about 50 miles northwest of Yachow. October 22. (R. M. S.)

RALLIDAE***Gallicrex cinerea* (Gm.)**

Fuliga cinerea Gmelin, Syst. Nat., 1, pt. 2, p. 702, 1789. (China, *ex* Latham.)

At 50 miles east of Yachow a specimen of this bird was secured August 2.

It is very small in all its measurements, the wing is only 194 mm., but the bird is not quite adult. (R. M. S.)

CHARADRIIDAE***Vanellus vanellus* L.**

Tringa vanellus Linnaeus, Syst. Nat., ed. X, 1, p. 148, 1758. (Sweden.)

A single male from Batang taken December 28. (R. M. S.)

***Pluvialis dominica fulva* (Gm.)**

Charadrius fulvus Gmelin, Syst. Nat., 1, pt. 2, p. 687, 1789. (Tahiti.)

A large series from Litang all taken toward the middle of October and all in winter plumage. One male from Camp 108 taken in June is in partial breeding plumage. (R. M. S.)

***Charadrius mongolus schäferi* de S.**

Charadrius mongolus schäferi de Schauensee, Proc. Acad. Nat. Sci. Philadelphia, 89, p. 340, 1937. (S. Kokonor, Tibet.)

A large series of males, females and fledgelings was collected at Camp 104, June 13.

The upper parts of this bird are very dark, the pectoral band dark and definite as in *C. m. mongolus*, but the forehead black as in *C. m. atrifrons*. (R. M. S.)

Charadrius dubius curonicus Gm.

Charadrius curonicus Gmelin, Syst. Nat., 2, p. 692, 1789. (Kurland.)

An unsexed bird from Dawo taken in September. (R. M. S.)

Charadrius placidus Gray and Gray.

Charadrius placidus, J. E. and G. R. Gray, Cat. etc. Mamm. Bds. Nepal and Tibet, Brit. Mus., ed. 2, p. 70, 1863. (Nepal.)

A male from Drupalong taken in January. (R. M. S.)

SCOLOPACIDAE

Tringa totanus eurhinus (Oberh.)

Totanus totanus eurhinus Oberholser, Proc. U.S. Nat. Mus., XXII, p. 207, 1900. (Tso Moriri, 15,000 ft., Ladak.)

A good series of adults from Jyekundo and Camp 103 taken during June, July and August.

The wings of the eleven birds vary between 153 mm. and 168 mm. (R. M. S.)

Tringa ochrophus L.

Tringa ochrophus Linnaeus, Syst. Nat., ed. X, 1, p. 149, 1758. (Sweden.)

Two males and a female were secured at Litang, Chorden Gomba and Camp 135 in September. (R. M. S.)

Tringa glareola L.

Tringa glareola Linnaeus, Syst. Nat., ed. X, 1, p. 149, 1758. (Sweden.)

Three males from Litang and Tangkama (Camp 14) taken in September and October. (R. M. S.)

Actitis hypoleucos (L.)

Tringa hypoleucos Linnaeus, Syst. Nat., ed. X, 1, p. 149, 1758. (Sweden.)

Specimens of this Sandpiper were collected at Waszekou, Dawo, Jyekundo, and Camp 135, during May, August and September. (R. M. S.)

Capella solitaria solitaria (Hodgs.)

Gallinago solitaria Hodgson, Gleanings in Science, 3, p. 238, 1831. (Nepal.)

A series of thirteen birds from Batang, Waterh, Sama (Camp 41), Jyekundo, and Camps 54, 62, 63, and 74, secured in February, March, April and May. (R. M. S.)

Scolopax rusticola rusticola L.

Scolopax rusticola Linnaeus, Syst. Nat., ed. X, 1, p. 146, 1758. (Sweden.)

A single female from Malashi (Camps 18-20) secured October 3, 1934. (R. M. S.)

Erolia temminckii (Leis.)

Tringa temminckii Leisler, Nachträge zu Bechstein's Naturg. Deutsch., p 64, 1812.
(Hanau am Main, Germany.)

A female from Camp 79, April 18, 1935.

This bird is not recorded by Schäfer in his paper on the fauna of Tibet in the Journal für Ornithologie, special publication of May 1938. (R. M. S.)

RECURVIROSTRIDAE**Ibidorhyncha struthersii** Vig.

Ibidorhyncha struthersii Vigors, Proc. Comm. Zool. Soc. London, I, p. 174, 1831.
(Himalayas.)

Seven adult birds were secured at Litang, Batang, Leh, and Derge in January, February, September and November. An immature specimen was collected at Camp 135, August 8 and two more at Tatsienlu, September 7, 1934. (R. M. S.)

LARIDAE**Sterna hirundo tibetana** Saund.

Sterna tibetana Saunders, Proc. Zool. Soc. London, p. 649, 1876. (Tibet.)

A series of eleven birds from Litang, Seshu (Camp 68) and Camps 103 and 104 in June and October have wings close to, or slightly over the maximum given by both Baker and Hartert. They range from 267 mm. to 284.5 mm. with an average of 276.7 mm. Hartert gives 255 to 276 mm. for the wing of this form.

Two immature birds were collected, one at Seshu and the other at Litang. (R. M. S.)

PTEROCLIDIDAE**Syrrhaptes tibetanus** Gould.

Syrrhaptes tibetanus Gould, Bds. Asia, pt. 2, pl. and text, 1850. (Tsomoriri, Ladak.)

A dozen specimens were secured at Camp 70, (wings 243-270 mm.) and 30 miles northeast of Jyekundo, (wings 245-261 mm.), in March and April. (R. M. S.)

COLUMBIDAE**Columba leuconota gradaria** Hart.

Columba leuconota gradaria Hartert, Nov. Zool., 23, p. 85, 1916. (Sungpan, Szechuan.)

At Camp 26, Leh, and Batang, specimens of the Snow Pigeon were collected during October, November, and December. (R. M. S.)

Columba rupestris rupestris Pall.

Columba oenas rupestris Pallas, Zoogr. Rosso-Asiat., I, p. 560, 1811. (Dauria.)

A series of ten birds from Litang, Waszekou and Camp 48, taken in August and February. Hartert and Steinbacher who examined series of these birds state that Riley's *austrina* is not recognizable. (R. M. S.)

Streptopelia orientalis orientalis (Lath.)

Columba orientalis Latham, Ind. Orn., II, p. 606, 1790. (China; ex Sonnerat.)

At Batang in October seven specimens were secured, some of which are immature. (R. M. S.)

Streptopelia tranquebarica humilis (Temm.)

Columba humilis Temminck, Pl. Col., 259, livr. 44, 1824. (Bengal, Luzon.)

Nine birds from Litang were secured in October. Their wings vary between 132-137 mm. (R. M. S.)

CUCULIDAE**Cuculus canorus bakeri** Hart.

Cuculus canorus bakeri Hartert, Vög. Pal. Fauna, 2, p. 948, 1912. (Shillong.)

A good series, all dark birds, from Tatsienlu, Yachow, Wangmu, Jyekundo, and Camps 76 and 136 taken in June and August. (R. M. S.)

Hierococcyx fugax nasicolor (Blyth).

Cuculus nasicolor Blyth, Journ. As. Soc. Bengal, XII, p. 948, 1843. (Nepal.)

An unsexed adult from Lengchi taken in the middle of July. (R. M. S.)

Eudynamis scolopacea chinensis Cab. and Heine.

Eudynamis chinensis Cabanis and Heine, Mus. Hein., IV, p. 52, 1862. (Canton.)

An adult male from Yachow in August. (R. M. S.)

PSITTACIDAE**Psittacula derbyana** (Fraser).

Palacornis derbyanus Fraser, Proc. Zool. Soc. London, p. 245, Aves, pl. 25, 1850 (1852). (Cagebird.)

One adult female with a wing of only 211 mm. was taken 50 miles east of Hokow in September. (R. M. S.)

STRIGIDAE**Strix davidi** (Sharpe).

Syrnium davidi Sharpe, Ibis, p. 256, 1875. (Mupin.)

Of this very rare owl there is one specimen in the collection from Batang taken December 21. Its measurements are as follows: wings 358 mm., tail 260 mm.

A specimen of *Strix nivicola* Blyth collected at Chengwei, Szechuan, by the first Dolan expedition measures: wing 307 mm., tail 194 mm.

In general appearance *Strix davidi* seems closer to *S. uralensis* than it does to *S. nivicola*, but differs from the former in being a great deal darker and having the base of the tail uniform dark brown. The facial disk however is heavily mottled and in this respect is closer to *S. nivicola*. (R. M. S.)

Bubo bubo tibetanus Bian.

Bubo bubo tibetanus Bianchi, Bull. B. O. Club, XVI, p. 69, 1906. (Tibet.)

Four of these large owls were collected at Seshu, Malashi (Camps 18-20), and Camps 103 and 128, in June, July, August and October.

The two males measure 450 mm. and 452 mm. The two females 480 and 502 mm.

A male and a female from Seshu (Camp 68) and Camp 123 show a very pale, almost grayish coloration below, while the male from Malashi (Camps 18-20), and the female from Camp 103 are quite rufescent on the underparts. Not recorded by Schäfer in his paper on the fauna of Tibet in the Journal für Ornithologie, special publication of May 1938. (R. M. S.)

Glauclidium cuculoides whiteleyi (Blyth.)

Athene whiteleyi Blyth, Ibis, p. 313, 1867. (China.)

Two females, one from Yachow and the other from Chungchow were collected August 1 and 3. They are in very poor plumage. (R. M. S.)

Athene noctua ludlowi Baker.

Athene noctua ludlowi Baker, Bull. B. O. Club, XLVII, p. 58, 1926. (Rham Tso, Tibet.)

The series of this owl was secured at Litang and Camps 62, 79, and 137, during March, April, July, August and September. Their wings measure 179-186 mm. (R. M. S.)

MICROPODIDAE**Micropus pacificus pacificus** (Lath.)

Hirundo pacifica Latham, Index Orn. Suppl., n. 58, 1801. (Australia.)

Seven males, seven females, Jyekundo, Chinghai, Tibet, upper Yangtze, May 19, 1935; two males, two females, three unsexed specimens, Camp 128, July 18, 1935. Wing measurements: males 176-190 mm.; females 177-190 mm.; unsexed 178-191 mm.

The White-rumped Swift is a common summer bird, distributed all over the Hsifan mountains and Khams going as far north as Chinghai, Tibet, where I found it still breeding near the juncture of the Chumar and Drechu. Being extremely gregarious, the birds live together in flocks and breed in loose colonies on towers or cliffs. Its habits are those of the common European swift but its voice is not as loud. (E. S.)

Collocalia brevirostris, subsp.

A pair was secured at Sanchopin in August. These birds are in worn plumage with the tips of the primaries broken off. Perhaps they are referable to *C. b. pellos* Thayer and Bangs. (R. M. S.)

UPUPIDAE

Upupa epops saturata Lönnerberg.

Arkiv. f. Zool., no. 9, p. 29, July 21, 1909. (Kjachta, Transbaicalia.)

Five males; two, Jyekundo, April 1, 1935; two, Jyekundo, April 9, 1935; one, Yalung (Camp 79), April 18, 1935; and one female, Tunggnolo, September 11, 1934.

Though the differences between *Upupa epops epops* and *e. saturata* are very slight, I finally decided to refer my specimens to the latter race. The Tibetan Hoopoe does not occur in the Hsifan mountains but is commonly found in Khams and Chinghai, Tibet. It frequents the nomad country and the open agricultural districts north of the timberline. It has semi-migratory habits, descending in winter into the erosion-canyons of the river gorges, where I found a few specimens wintering near Batang at an altitude of 2700 meters above sea level. (E. S.)

PICIDAE

Picoides tridactylus funebris Verr.

Picoides funebris Verreaux, Nouv. Mus. Paris, VI, Bull., p. 33, 1870. (Montagnes du Thibet chinois.)

One unsexed specimen, Malashi, October 3, 1934, with a wing length of 123 mm.

Resident of the densest and darkest, subalpine, coniferous (spruce and fir) forests of the Hsifan mountains and Khams, Chinese Tibet. A rare bird. In Tibetan territory it lives in the same habitat as the rare Jay, *Crates internigrans*. (E. S.)

Dryobates hyperythrus miniakorum Meise.

Abh. u. Ber. Mus. Tier-u. Volkerk. Dresden, XVIII, p. 53, 1934. (Tatsienlu, West Szechuan.)

One male, Hokow, September 9, 1934, wing 122 mm.; one female, Batang, January 18, 1935, wing 118 mm. Both birds in fine winter plumage.

I found the Rufous-bellied Pied-Woodpecker only in Tibetan territory (Khams). It is a rare bird, inhabiting the deciduous woods, willows and *Hippophae* thickets of the valley bottoms, avoiding dense coniferous woods. (E. S.)

Dryobates major stresemanni Rensch.

Abh. u. Ber. Mus. Tier-u. Volkerk. Dresden, XVI, p. 38, 1923. (Tatsien-lu.)

One male, Malashi, south of Litang, October 5, 1934; another male, Beyü, February 7, 1935; one unsexed specimen, Batang (Leh), November 14, 1934.

Wing measurements; males 136-140 mm.; unsexed 140 mm.

I was able to compare a fine series of seven birds of this race from Khams with a large series of *Dryobates major beicki* from Kansu (Berlin Museum) and found that the two races according to Stresemann (Orn.

Monatsber., XXXV, p. 134, 1927) are very distinct. The broader extension of the black markings on the two outer tail-feathers is not constant. In the case of *stresemanni*, however, the five first primaries are without white edgings; the white tips of the other primaries are very much smaller than in the case of *beicki*, and in the latter race the first five primaries are also tipped with white.

Out of sixteen specimens from Kansu, thirteen show these characters uniformly. Therefore I refer my three specimens to *stresemanni*. The safest distinction between the two races is the much darker brownish color of the underparts of *stresemanni*, which is constant throughout my material.

Not very common, but widely distributed over the mountains of Hsifan and Khams, only in the wooded regions. The bird is especially fond of the dense thickets of *Hippophae salicifolia* in the bottom of the valleys, ranging from about 2700 up to 4300 meters. (E. S.)

Dryobates nanus omissus Rothschild.

Bull. B. O. Club, XLIII, p. 10, 1922. (Likiang mountains, northwestern Yunnan.)

One female, Chungchow, northeast of Yachow, August 2, 1934, with 104 mm. wing length.

This bird seems to be restricted to the subtropical parts of the Red Basin of Szechuan, not penetrating the Hsifan mountain of Tibet, the limit of its range lying near Yachow and Kwanhsien on the borderline of the Hsifan mountains. (E. S.)

Dryocopus martius khamensis (But.)

Picus khamensis Buturlin, Annuaire Mus. Zool. Acad. Imp. St. Pétersbourg, XIII, p. 229, 1908. (Eastern slopes of the great plateau of Tibet.)

One male from Leh, south of Batang, November 13, 1934, wing length 260 mm.

The Tibetan Great Black Woodpecker lives only in physiogeographically Tibetan country; it is quite rare, and inhabits the subalpine coniferous woods, at altitudes from 3500 to 4500 meters. It is especially fond of tall single trees along the edges of the forests, avoiding the densest parts. (E. S.)

Picus canus sordidior (Rippon).

Gecinus sordidior Rippon, Bull. B. O. Club, XIX, p. 32, 1906. (Yangtze river, W. Yunnan.)

Two males: one, Yachow August 3, 1934, wing 145 mm.; one, Lengchi (Hsifan mountains) August 17, 1934, wing 150 mm.

Two females: one, Chungchow northeast of Yachow, August 1, 1934, wing 144 mm.; one Sanchopin, Hsifan mountains August 15, 1934, wing 148 mm. All these specimens are in moult.

In accordance with Riley's statement, saying that the green color of these birds fades markedly, Stone, while working with the material of the

first Dolan expedition to Western China, drew the conclusion that all "Szechuan birds" must be referable to this race. My material, however, shows that there are two very distinct races: *sordidior*, (to which I refer the above mentioned specimens), which is darker, more olive green, and smaller in size, inhabiting the Red Basin of Szechuan and the low sub-tropical valleys of the Hsifan mountains; and *kogo*, which is lighter and considerably larger, ranging over physiogeographically Tibetan territory.

Sordidior is a common bird around the villages, temple gardens, parks, and groves of the Red Basin; in the Hsifan mountains it seems to be restricted to the drier valleys, avoiding jungle districts and dense woods. (E. S.)

***Picus canus kogo* (Bian.)**

Gecinus guirini kogo Bianchi, Bull. B. O. Club, XVI, p. 69, 1906.

Picus canus stresemanni Yen, Orn. Monatsber., p. 17, 1933. (Siningfu, Kansu.)

One adult male, Beyü (Camp 58), February 7, 1935, wing 157 mm.; five females, all of which are in fine winter plumage; one, Dawo, October 3, 1935; four, Beyü February 7, 1935. These five female specimens measure 154-158 mm. in the wings.

This race occurs only in Tibetan territory, where it is fond of the poplar trees in the bottom of the valleys in the neighborhood of streams and rivers. It is larger and lighter than the subtropical form *sordidior*. (E. S.)

***Jynx torquilla chinensis* Hesse.**

Orn. Monatsber., p. 181, 1911. (Tsingtau.)

One male, Tunggnolo, September 11, 1934; one pair, Jyekundo, June 9, 1935; one unsexed specimen, Dawo, September 7, 1935.

Wing measurements: males 88-90 mm.; females 89 mm.; unsexed 86 mm.

This bird lives only in Tibetan country; it does not occur in the Hsifan mountains and breeds entirely in Khams and Tibet. I found it fairly rare along the great rivers where it inhabits deciduous forest and even goes far northward beyond the timber-line, where it breeds in loess holes north of Jyekundo in the valley of the Yangtse river. (E. S.)

ALAUDIDAE

***Eremophila alpestris khamensis* (Bian.)**

Otocorys chvesi khamensis Bianchi, Ibis, p. 732, 1904. (Kham, southeastern Tibet.)

Nine males: three, Litang, September 24, 1934; one, steppe west of Litang, September 21, 1934; one, Litang, October 9, 1934; four, Gemoh (Camp 33), January 22, 1935. The wings of these males measure 115-123.5 mm., and the bills 10-12 mm.

Three females: two, Litang, one September 24, 1934, the other, October 9, 1934; and one, Gemoh (Camp 33), January 22, 1935. The wings of these females measure 111-116.5 mm. and the bills 11-11.5 mm.

This series corresponds to the description, the bills being larger than those from the highest and more northern parts of Tibet. I refer all these specimens to *khamensis*.

This race lives in southern Khams (Chinese Tibet) above the timberline and on the plains of the Khams gazelle steppes. It does not occur in the Hsifan mountains. (E. S.)

***Eremophila alpestris elwesi* (Blanf.)**

Otocoris elwesi Blanford, Journ. As. Soc. Bengal, p. 62, 1872. (Kangra-Lama Pass, between 15,000 and 16,000 feet in Sikkim.)

One pair from the high steppe country near Seshu, north of the tree limit, Camp 61, February 25, 1935; the male measuring 120.5 mm. in the wing and 10 mm. in the beak, the female 119 mm. wing and 9 mm. beak.

Five females: Camps 78, 79, upper Yalung steppes, April 18, 1935; four, Camp 103, June 12, 1935. The wings of these birds measure 110-116 mm. and the bills 10-11 mm.

This race is lighter than *khamensis* on the upper parts. It lives only north of the timberline in the highest and most desolate Tibetan steppe country, on the upper course of the Hoangho, Yalung, and Yangtse. (E. S.)

***Alauda arvensis inopinata* Bianchi.**

Ann. Mus. Zool. St. Pétersbourg IX, p. XXXI (Eastern Tibet.)

Fourteen males: one, west of Tatsienlu, September 10, 1934; two, Litang, September 24, and October 11, 1934; one, near Camp 22, October 15, 1934; three, Batang, December 28, 1934; one, Gemoh, January 22, 1935; three, Jyekundo, April 6, 1935; two, near Camp 77, upper Yangtse near Jyekundo, April 16, 1935; and one, Seshu on the upper Yalung, August 28, 1935. These males measure 99-110 mm. in the wings.

Seven females: two, Litang, September 24, and October 11, 1934; one, Batang, December 28, 1934; one, Gemoh, January 22, 1935; two, Jyekundo, April 6, 1935, and one, Seshu, August 28, 1935. These specimens measure 98-104.5 mm. in the wings.

Two unsexed specimens: one from Batang taken December 28, 1934, measuring 103 mm. in the wing, and one without date from the vicinity of the upper Yalung or Yangtse, near Jyekundo, measuring 101 mm.

All these Tibetan specimens are a little darker in color than the Kansu specimens collected by Beick (Berlin Museum). The differences are very slight, and can only be seen in large series. I do not have sufficient evidence to recognize the Tibetan birds as a new subspecies and therefore refer all of them to *inopinata*.

A common bird in the agricultural valleys and on the grassy steppes of Sikong (Khams) and Chinghai. This larger race is replaced by *Alauda arvensis weigoldi* in the subtropical Red Basin of Szechuan and in the lowlands of China. (E. S.)

***Calandrella brachydactyla dukhunensis* (Sykes).**

? *Emberiza bagheira* Franklin, Proc. Zool. Soc. London, p. 119, 1831. (nom. nudum.)

Alauda dukhunensis Sykes, Proc. Zool. Soc. London, p. 93, 1932. (Dukhun, India.)

Five adult males were taken near Jyekundo (Camp 73), April 12, 1935, measuring 97-98 mm. in the wings.

One unsexed specimen, same date and locality, measures 93 mm. in the wing.

Fourteen females from the same locality, taken April 12, 1935, measure 91.5-94 mm. in the wing.

One female, migrating, from Tailing northwest of Tatsienlu, taken September 28, 1934, measures 93 mm. in the wing.

With this bird dimorphism in sex seems to be pronounced and constant. Seven females show the following scale:

Bill 9.5 mm.; tarsus 19-20.5 mm.; hind toe 15-18.5 mm.; hind claw 9-12 mm.

The variation in color from light to dark, due to abrasion on the upper parts, is striking. Thus the specimen from Tailing, which is much abraded, is the darkest of all. The black central stripes of the upper headfeathers also show abrasion of the same kind to varying degrees. The reddish-gray wash of the chest and the blackish spots on each side of the neck also show great individual variation in their intensity of color. The blackish spots on the sides of the neck are merely indicated by being dark gray in color in the case of a few specimens.

This bird breeds only in the highest and northernmost Tibetan steppe country. There it is quite plentiful. (E. S.)

***Calandrella acutirostris tibetana* Brooks.**

Calandrella tibetana Brooks, Stray Feathers, VIII, p. 488, 1880. (Tibet beyond Sikkim.)

A large series of thirty-five birds was taken near Jyekundo and on the upper Yalung river near Drechu Gomba; six males taken near Camp 79, April 18, 1935; one male, Camp 76, June 8, 1935; three males, Camp 78, June 17, 18, 1935. These ten birds were closely examined, while all thirty-five birds were measured, producing the following scale. The sex identification was difficult and uncertain.

Wing 95-100 mm. (average, 97 mm.); bill 10-11 mm.; tarsus 20-22 mm.; hindtoe 15-18.5 mm.; hindclaw 8-13 mm.

Four birds taken from Sikkim, which Dr. Kinnear sent me on loan, measure 94-98 mm., while five birds from Ladak, (which Mr. Whistler was so kind as to send me on loan) measure 86-98 mm.

The eastern Tibetan birds therefore seem to be slightly larger than the Sikkim specimens, which are intermediate and much larger than Ladak birds; the latter belong to *Calandrella acutirostris acutirostris*. Also in

color the Sikkim specimens seem to be intermediate between my birds and those from Ladak. According to the material on hand the two races are clearly distinguishable. The entire underparts of *tibetana* (my specimens) are dusker gray, not washed with brown or even yellow, as in *acutirostris*. Particularly the chest is purer gray in *tibetana*, not brownish gray as in *acutirostris*, the throat being in both races very light. The dark spots on either side of the neck seem to be more pronounced in *tibetana*. There seems to exist a great deal of individual variation in the color of the upperparts, varying also, on account of featherwear, from light sandy desert gray in fresh plumage, to a browner gray in worn plumage, according to the season.

I found unmistakable evidence that my eastern Tibetan specimens show a lighter and purer gray than Ladak birds. Ladak birds also seem to be more striped with blackish and brown markings on the backs. Another distinguishing mark between the two races is the amount of white in the outer tail feathers, which is largest and purest in my birds, smallest in Ladak birds. I therefore refer all my specimens to *tibetana*.

The bird breeds in the highest Tibetan steppe country near Jyekundo. It seems to be very fond of stagnant pools or slow-flowing rivers and streams, sometimes wading in the water in search of food. (E. S.)

***Melanocorypha maxima holdereri* Reichenow.**

Orn. Monatsber., p. 34, 1911. (Kansu.)

Five males; one, Camp 61, February 25, 1935; four, Camp 79, upper Yalung river, April 18, 1935. These birds measure 148-157 mm. in the wing.

This race inhabits only the northernmost parts of the Tibetan plateau, near the sources of the great rivers north of the timberline. (E. S.)

***Melanocorypha maxima maxima* Gould.**

Bds. Asia, IV, pl. 72. (Borders of Sikkim, Hartert.)

Four males and four females from Litang, October 8, 1934. The males measure 151.5-158 mm., the females 136-138 mm. in the wing.

This dark-colored form lives in Khams (Chinese Tibet) on the swampy places of the gazelle steppes. It is easily recognized by its dull upperparts. Farther north in the highest Tibetan steppe country *Melanocorypha maxima holdereri* takes its place. (E. S.)

HIRUNDINIDAE

***Hirundo rustica gutturalis* Scopoli.**

Del. Flor. et Faun., Insubr., II, p. 96, 1786. (Panay, Philippines).

One male, one female, Yachow, Szechuan Red Basin, August 3, 1934, both birds are badly moulting.

Wing measurements: male 111 mm., female 110.5 mm.

The Eastern Swallow is a common breeding bird in the subtropical Red Basin of Szechuan, near Kwanhsien, and Yachow, establishing last outposts of its range along the spurs of the high Hsifan mountains.

It does not occur in the mountains of Khams in Tibetan territory as a breeding bird, but I observed several migrating specimens in April and in the beginning of May, 1935, on the upper Yalung river, near Drechu Gomba, five days northeast of Jyekundo. (E. S.)

***Hirundo daurica nipalensis* Hodgson.**

Journ. As. Soc. Bengal, V, p. 780, 1836, 1837. (Central region of Nepal.)

One male and one unsexed specimen, Yachow, Szechuan Red Basin, August 3, 1934; both birds in moult.

Wing measurement: male 113 mm.; unsexed 112 mm.

Though Professor Steinbacher in "Die Vögel der Paläarktischen Fauna", Ergänzt. Bd., Heft 4, p. 348, comes to the conclusion that all the birds from Eastern Asia (the Far East), Manchuria, Korea, Japan, Chihli, and the whole of China, Kwangsi, Kwangtung, Fohkien, must be called *japonica* Temm. and Schleg., Professor Stresemann and myself are inclined to consider *nipalensis* a separate race. It seems impossible that the bird, which in other countries shows great tendencies for geographical and ecological variation, does not split into separate races in the above mentioned large area. The grounds for Professor Steinbacher's reasoning probably lies in the fact that most series hitherto collected were very small, not allowing comparison of large numbers of skins. Therefore I refer all my specimens to *nipalensis*.

I compared these birds with six specimens from Kwanhsien, in the Red Basin of Szechuan, and found them identical. This rather small and dark race of Daurian Swallow inhabits only the above mentioned subtropical plains, while the much larger race *gephyra* takes its place in the Hsifan mountains and the southern and southeastern parts of Khams, Chinese Tibet. In the highest Tibetan country however, *gephyra* is replaced by a considerably larger race of Daurian Swallows. (E. S.)

***Hirundo daurica gephyra* Meise.**

Abh. u. Ber. Mus. Tier-u. Volkerk. Dresden, XVIII, No. 2, p. 48, 1934. (Kansu.)

One male Waszekou, Tung valley 24 km. southeast of Tatsienlu, August 20, 1934. The wing of this specimen measures 120 mm., compared with eleven specimens from Sungpan and Kansu, which measure from 120-123.5 mm., it proves to belong to this race.

This race of Daurian Swallow inhabits the mountainous parts of Hsifan and is commonly found as a breeding bird on the houses of southeastern Tibetan farms and near villages of Khams. In the Red Basin of Szechuan it is replaced by *Hirundo daurica nipalensis* and in the most desolate and highest parts of the Tibetan steppe country its place is taken by another larger race. *Gephyra* seems to breed only on houses, the birds are very tame. The Tibetans take great care of the nests on their houses as they consider them omens of good luck and health. (E. S.)

***Hirundo daurica tibetana* Schäfer.**

Proc. Acad. Nat. Sci. Philadelphia, 89, p. 385, 1937. (South of Litang, Sikong.)

Type in Academy of Natural Sciences of Philadelphia.

Seven males, six females, ten unsexed specimens, Jyekundo, Chinghai, Tibet, upper Yangtse river, June 6, 1935; three males, one female, Camp 79, June 10, 1935; two females, Camp 132, July 22; two males, Camp 144, September 3, 1935.

Wing measurements: males 126-131 mm.; females 125-128 mm.; unsexed 123-130 (123-131) mm.

These high Tibetan Striated Swallows are very much larger than true *gephyra* specimens! I cannot find any distinction in color from this latter race.

The bird is commonly found breeding in the villages and Tibetan farm houses of the northernmost agricultural districts around Jyekundo on the upper Yangtse, but it also breeds in cliffs, forming large colonies, in the Yalung and uppermost Yangtse steppe country. (E. S.)

***Hirundo urbica cashmeriensis* (Gould).**

Chelidon cashmeriensis Gould, Proc. Zool. Soc. London, XXVI, No. 356, 1858. (Kashmir.) Sharpe and Wyatt, Monogr. Hirundin., pl. B.

Eleven males, five females, Jyekundo, Chinghai, Tibet, May 19, 1935; two females, one male, Camp 76, June 8, 1935; one female, Camp 132, July 23, 1935; one male, one female, Camp 144, September 3, 1935.

Wing measurements: males 98-109 mm.; females 102-108 mm.

Eight specimens have wings longer than 103 mm. as compared with five birds from Wassu country, which measure from 93-100 mm. These high Tibetan birds are considerably larger. They may prove to belong to a hitherto undescribed race.

In Tibet the Kashmir Martin never breeds in houses; it is a cliff-bird, often found with *Hirundo daurica*. It is distributed over the Hsifan mountains as well as over most parts of Khams, ranging into Chinghai, Tibet, where its northern limit lies in the valley of the uppermost Yangtsekiang. (E. S.)

***Riparia riparia tibetana* (Stegmann).**

Compt. Rend. Ac. Sci. Russie, p. 39, 1925. (Ostlicher Nanschan.)

Seven males, two females, seventeen unsexed specimens, Jyekundo, Chinghai, Tibet, Upper Yangtse River, (Camp 79), April 28, 1935, the wings of these specimens measure 103-109 mm.; one young female from Camp 79, August 8, 1935, in juvenal plumage measures 102 mm. These specimens might prove to be a little darker than typical *tibetana*.

I found this bird only in the highest Tibetan country. North of Jyekundo it was quite common in the open Kiang steppe, where I found it breeding in holes along the steep river banks. (E. S.)

Riparia rupestris rupestris (Scop.)

Hirundo rupestris Scopoli, Annus I, Historico Nat., p. 167, 1769. (Ex Comitatu Tyrolensi.)

Seven males, four females, and one unsexed specimen taken near Batang, Khams, Yangtse river, October 24, 26, 1934.

Wing measurements: males 129-136 mm.; females 130-134 mm.

These specimens from Batang in full winter plumage show a light yet distinct rusty or yellowish color on the underparts.

I was able to compare twenty-four specimens of Crag Martins from the neighborhood of Sungpan, Maochow, Tehoksi (Drukagi) and Batang, all taken in Khams or Sikong, which all belong to the same race, with a wing length of 123-136 mm.

In the rocky regions of the northern Hsifan mountains (Maochow) and Sikong, Chinese Tibet, this bird is restricted to the arid river gorges, with high temperatures and xerophil vegetation. It breeds in the most inaccessible cliffs. (E. S.)

Riparia rupestris centralasica Stachanow.

Bull. B. O. Club, LIII, p. 184, 1933. (Ala Shan Mts.)

Thirty-one males, six females; Jyekundo, Chinghai, Tibet, upper Yangtse river, April 10, 1935.

Wing measurements: males 131-144 mm.; females 134-135 mm.

Sixteen of these thirty-seven specimens exceed 136 mm. in wing-length. I therefore refer all these birds to the race *centralasica*, though I am unable to recognize the paler and more sandy color. All of them are in fresh plumage, collected near their breeding places.

This race of high Tibetan Crag Martin gives fine evidence, which is true also of other swallows, that the birds of the highest and northernmost Tibetan regions prove to be very much larger than the specimens taken in southern Khams or in the Hsifan mountains. Near Jyekundo and on the uppermost Yalung and Yangtse with its tributaries, this large race of Crag Martin is quite common, breeding in cliffs along the banks of the rivers. (E. S.)

CAMPEPHAGIDAE**Pericrocotus brevirostris ethologus** Bangs and Phillips.

Pericrocotus brevirostris ethologus Bangs and Phillips, Bull. Mus. Comp. Zool Harvard, LVIII, p. 282, 1914. (Hsienshan, Hupeh.)

Two females from Dawo secured in September. (R. M. S.)

DICRURIDAE**Chibia hottentotta brevirostris** Cab. and Heine.

Chibia brevirostris Cabanis and Heine, Mus. Hein., I, p. 112, 1850. (China.)

A male from Yachow and another from Huangnipu taken in August. Both birds are moulting. (R. M. S.)

ORIOLIDAE

Oriolus chinensis diffusus Sharpe.

Oriolus diffusus Sharpe, Cat. Birds Brit. Mus., III, p. 197, 1877. (Malabar.)

Three adult males and two adult females from Chengtu were secured in July, and an immature pair at Yachow in August. (R. M. S.)

CORVIDAE

Corvus corax tibetanus Hodgs.

Corvus tibetanus Hodgson, Ann. and Mag. Nat. Hist., (2), III, p. 203, 1849. (Tibet.)

A series of a dozen birds collected at Litang, Batang, Kanze and Camps 13, 16, 23, 47, and 143, during September, October, November and February.

The wings of these birds measure from 450 mm. up to 492 mm.

Some of the birds have a couple of white primary features. (R. M. S.)

Corvus corone orientalis Eversm.

Corvus orientalis Eversmann, Add. Pall. Zoogr., fasc. II, p. 7, 1841. (Near the Naryn river.)

A single female was collected in August at Lutingkiao. (R. M. S.)

Corvus leuallanti intermedius Adams.

Corvus intermedius Adams, Proc. Zool. Soc. London, p. 171, 1859. (Kashmir, Dugschai and Simla.)

At Yachow, Hokow, Dawo, Batang, Seshu, Chengtu, and on the Gur La pass, a good series of these crows was secured during May, July, August, September, October, November and December.

The males have wings measuring from 343 mm. to 368 mm., the females 322 mm. to 352 mm. and one unsexed bird has a wing of no less than 373 mm.

Although some of these birds measure up to the size given for *tibetosincensis* Klein. and Weig., many are well within the wing range given by Hartert for *intermedius*. (R. M. S.)

Corvus frugilegus pastinator Gould.

Corvus pastinator Gould, Proc. Zool. Soc. London, p. 1, 1845. (Chusan, China.)

One female from Chengtu, July, with a wing of 289 mm. (R. M. S.)

Corvus torquatus Less.

Corvus torquatus Lesson, Traité d'Orn., p. 328, 1831. (South China.)

Five birds from Yachow and one from Chengtu are in the collection. They were collected during July and October. (R. M. S.)

Coloeus dauricus major Bian.

Coloeus dauricus major Bianchi, Ann. Mus. Acad., Zool. St. Pétersbourg, p. 11, 1903.

A large series of this form with wings ranging up to 249 mm. (Batang and Jyekundo) were secured at Malashi (Camps 18-20), Beyü (Camp 46), Batang (Camp 24), Tunggnolo (Camp 5), Litang and Jyekundo during February, May, August, September, November and December.

Birds in both the normal and in the dark phase (*C. fuscicollis* Vieil.) were secured in all localities at which the birds were collected. (R. M. S.)

***Pica pica sericea* Gould.**

Pica sericea Gould, Proc. Zool. Soc. London, p. 2, 1845. (Amoy, China.)

One immature female, in postjuvénal moult, Chengtu, July 30, 1934, measuring 201 mm. in the wing.

The Chinese Magpie is one of the most common birds around all Chinese villages in the subtropical Red Basin of Szechuan, but it also frequents the Hsifan mountain ranges, ranging as far as Tatsienlu on the border of Hsifan and Tibet proper (in a geographical and biological sense). The Chinese Magpies are very much tamer than the European birds, but otherwise I found them not much different from western birds in their habits. Their nests are commonly found on tall trees overshadowing the village houses. (E. S.)

***Pica pica bottanensis* Deless.**

Pica bottanensis Delessert, Rev. Zool., p. 100, 1840. (Boutan, au Nord du Bengale.)

Four males: one, Tunggnolo, September 11, 1934; one, Camp 24, October 11, 1934; one, Litang, October 21, 1934; one, Batang, January 30, 1935. Three females: one, Batang, November 1, 1934; one, December 12, 1934; one January 30, 1935.

Wing measurements: adult males 241-259 mm.; females 233-250 mm.

The Tibetan Black-rumped Magpie ranges only over physiogeographical Tibetan territory, while *Pica pica sericea* takes its place in the Szechuan Red Basin as well as in the deep valleys and agricultural districts of the Hsifan mountains. The Black-rumped Magpie is one of the most characteristic birds of the nomad country, and the Tibetan farming districts, where it lives and breeds in the neighborhood of human habitation, often becoming very tame and impudent. The bird avoids the dark dense forest zone and is uncommon in the high alpine region; it also does not penetrate the most desolate and high Tibetan steppes. The gazelle steppes of Khams forming its favorite habitat, it is rarely found in the Kiang steppes. Following the gorge of the rivers northward it is quite common on the Yangtsekiang near Jyekundo. (E. S.)

***Urocissa erythorhyncha erythorhyncha* (Gm.)**

Corvus erythorhynchus Gmelin, Syst. Nat., I, 1, p. 390, 1788. (Ex Latham, China.)

One female in very worn plumage secured at Chungchow, August 1, 1934. (R. M. S.)

***Nucifraga caryocatactes macella* Thayer and Bangs.**

Nucifraga hemispila macella Thayer and Bangs, Bull. Mus. Comp. Zool. Harvard, LXII, p. 140, 1909. (Hsien-shawhsien, Hupeh.).

One adult male, Lengchi, Tung valley, Hsifan mountains, August 17, 1934. The wing in this specimen measures 213 mm.

The Nuteracker does not occur in true Tibetan country but is restricted to the high mountains of Hsifan, where it lives in the mixed deciduous and coniferous forests above the arid river valleys. In the autumn the birds may frequently be met with in large numbers, plundering the walnut trees in and around the native villages. At this time of the year they grow quite tame. During the breeding season however, the birds live higher in the mountains, where they are shy and solitary and not easily approached. (E. S.)

***Garrulus glandarius sinensis* Swinh.**

Garrulus sinensis (Gould) Swinhoe, Proc. Zool. Soc. London, No. 19, p. 304, 1863. (Canton to Ningpo.)

One male, Chungchow, August 1, 1934, wing 177 mm. This bird belongs to *sinensis* without doubt.

One pair, Batang, December 9, 1934, male 189 mm., female 179 mm. in the wing.

These two birds and one which Weigold collected near Tsaupo, Wassu, in the Hsifan mountains are different from those from the Red Basin of Szechuan (of which I was able to compare a series of five specimens). The top of the head is mottled with fine black stripes and the general color is darker, duskier, especially on the back. Chin and throat are more reddish than in true *sinensis*, the chest is darker reddish with a gray tinge. The two forms seem to mingle near Yachow and Kwanhsien on the border of the Red Basin of Szechuan.

I am nearly convinced that the mountain form of Hsifan and Khams, which becomes very much rarer as its range extends northwestwards, will prove, on the examination of more material, to belong to a darker and duskier race. Owing to the lack of material, however, I hesitate to describe it as a new race at the present time. *Sinensis* is a common bird in the pine forests of the subtropical Red Basin of Szechuan, while the rarer duskier mountain form is fond of subtropical jungles with tall trees in the neighborhood of human habitation. Near Batang, however, the bird seems to be restricted to the prickly oak forest in altitudes of 3800 to 4500 meters. (E. S.)

***Pyrrhocorax pyrrhocorax himalayanus* (Gould).**

Fregilus himalayanus Gould, Proc. Zool. Soc. London, p. 125, 1862. (Himalayas.)

In the collection are four males, seven females and two unsexed birds from Litang, Kanze, Jyekundo, and Camps 70 and 126 taken during September, October, April, July, and August.

They are all large birds with a wing range varying between 300 mm. and 333.5 mm.

Three immature birds were secured at Camp 126, July 11, 1935. (R. M. S.)

***Pyrrhocorax graculus forsythi* Stol.**

Pyrrhocorax forsythi Stoliczka, Stray Feathers, p. 462, 1874. (Ladak.)

A small series consisting of two males, two females and one unsexed specimen collected on the Tsong Ben La pass and at Leh during October and November.

The males measure 298 mm. and 302 mm., the females 272 and 273 mm., and the unsexed bird 268 mm. (R. M. S.)

***Pseudopodoces humilis humilis* (Hume).**

Podoces humilis Hume, Ibis, p. 408, 1871. (Yarkand, Sanju-Pass.)

Four males, two females in fresh winter plumage, Litang, September 24, 1934; two males and one unsexed specimen, Seshu, February 25, 1935; one pair and one unsexed specimen, all in breeding plumage, Jyekundo, April 1, 1935; one pair, Jyekundo, April 4, 1935; one male, Jyekundo, June 1935; one male, Camp 145, September 5, 1935.

Wing measurements: males 89-96 mm.; females 90-94 mm.; together 89-93 mm.

The Litang specimens are slightly darker on the upper parts than the birds from Jyekundo, while the Jyekundo birds again are a slight degree darker than the birds from Kansu (Beick coll. Berlin Museum), which also are markedly smaller (separated by Stresemann as *Pseudopodoces humilis saxicola*, Orn. Monatsber., p. 82, 1928).

This bird belongs to the typical fauna of the Tibetan steppe country where it lives in the same environment as *Ochotona melanostoma*. The favorite haunts of *Pseudopodoces humilis* are the yak pastures where it breeds in holes which it digs itself in loess walls. It is not as closely associated with the little steppe rodents as *Montifringilla mandelli* or *Montifringilla ruficollis*, but often enters the holes of mouse-hares. In search of food these birds move about the plains digging in yak chips. They are poor and feeble flyers, but very good on foot; being gregarious they sometimes breed in small colonies, but their parties are seldom joined by other species. Their range begins near Litang, Bamutang, and Kanze, in the south and southeast, but they are widely distributed over the high plateau-land of Tibet, and do not show much tendency to vary in color or size. (E. S.)

PARIDAE***Parus major tibetanus* Hartert.**

Vög. Pal. Fauna, I, p. 346, June 1905. (Chaksam, Tsongpo Valley, Tibet.)

Eight males: three, Dawo, October 1, 1935; five, Batang, October 10, 1934; one, November 11, 1934; two, December 6, 1934; one, December 28, 1934.

Five females: one, Malashi, October 2, 1934; three, Dawo, October 1, 1935; two, Batang, November 11, 1934, and December 6, 1934.

All birds are in fine winter plumage.

Wing measurements: males 75.5-79 mm.; females 68-77 mm.

While there are all intermediate stages between *artatus* and *tibetanus* (*subtibetanus* Kleinschmidt and Weigold in Abh. u. Ber. Mus. Tier- und Völkerk. Dresden, XVI, p. 11, 1923) in the lower mountain ranges of the Hsifan mountains, these birds are referable to *tibetanus*.

These are common birds in the arid river gorges and the agricultural districts of Khams ranging north as far as Jyekundo on the upper Yangtse. They avoid the dense forest districts and the high alpine districts above the timberline. (E. S.)

***Parus rufonuchalis beavani* (Jerd.)**

Lophophanes beavani Jerdon, Bds. India, II, p. 275, 1863. (Mt. Tongloo, in Sikkim.)

Nine males: one, Magidrong, September 18, 1934; one, Tunggnolo, September 13, 1934; one, Hsignolo, September 20, 1934; four, Malashi, September 29, 1934; two, Batang, November 5, 1934. Five females: one, Tunggnolo, September 13, 1934; one, Magidrong, September 19, 1934; one Hsignolo, September 20, 1934; two, Malashi, September 29, 1934. All are adult specimens in fresh winter plumage.

Measurements:

	Wing	Beak	Tail
Males	67-71 mm.	11-12 18-20 mm.	47-48 mm.
Females	65-67 "	10-11 18-20 "	45-49 "

The bills of these birds are larger than those of Sungpan specimens, the latter seeming to be intermediate between *whistleri* and *beavani*.

	Males	Females	Wing meas.
True <i>beavani</i> from Sikkim	69-74	64.5-72.5 mm.	" "
Khams, west of Tatsienlu	67-71	65-67	" "
Sungpan	62-66	61.5-65	" "
True <i>whistleri</i> from Kansu, (Orn. Monatsber., p. 108, 1931)	65	60-62.5	" "

These measurements show that the birds from Kansu (*whistleri*) and those from Sikkim (*beavani*) form very good races, while the birds from Sungpan and Khams are intermediate, the former showing more affinity to *whistleri*, the latter more to *beavani*. Therefore I refer all specimens to *beavani*.

These common birds are widely distributed over the palaearctic coniferous zone of eastern Tibet. They live together in large parties of ten to twenty specimens and are generally accompanied by other titmice (*Parus dichrous wellsi*, *Lophobasiliscus elegans meissneri*), or Tree Creepers. (E. S.)

***Parus dichrous wellsi* (Baker).**

Bull. B. O. Club, XXXVIII, No. CCXXVII, p. 8, Oct. 30, 1917. (W. Yunnan, Yangtse big bend.)

One male, Tunggnolo, September 13, 1934; two males, Hsignolo, September 20, 1934; one female, Hokow, September 15, 1934; three males, Malashi, south of Litang (Camps 18-19), October 3, 1934; two pairs, Batang, November 20, 1934; one female, one unsexed specimen, Beyü (Camp 46), February 2, 1935.

Wing measurements: males 69-77 mm.; females 71-75 mm.; unsexed 77 mm.

The specimens from Kansu (Berlin Museum) are true *dichroides* with brown-olive tinged upper parts and rather large white band on the neck with an altogether lighter color, while the specimens from Sungpan in northern Szechuan are intermediate between *dichroides* and *wellsi*. All my birds (including the population of the Washan, which is the southeastern outpost of the Hsifan mountain ranges) belong to the much darker races, *wellsi*. There seem to exist all the intermediate stages between the two races. My specimens collected at regular intervals on the march westward from Tatsienlu to Batang, gradually become darker as their range extends westward. I regard this as another proof that the Washan, with its palaearctic elements, belongs to the Yunnan-Himalaya-Khams (Tatsienlu-Batang) region and has no affinities with the faunistic region of the Sungpan-Kansu fauna.

This titmouse inhabits the palaearctic, coniferous wood zone of eastern Tibet, following the gorges of the great rivers from Yunnan into Tibet, the northernmost tree line forming the limit of distribution. The birds are not very common but are generally found in parties of other birds such as *Lophobasileus elegans meissneri* or *Parus rufinuchalis beavani*, the latter bird being a most common inhabitant of the same environment. (E. S.)

***Parus superciliosa* Przew.**

Pocille superciliosa Przewalski, Mongol i Strana Tangut, 2, p. 53, 1876. Transl: Rowley's Orn. Misc., II, p. 189, 1877. (Alpine region of the mountains of Kansu.)

Seven males: one, Seshu, September 1, 1935; one, Malashi, October 5, 1934; five, Jyekundo, April 4, 13 and May 24, 1935.

Four females: one, Seshu, September 1, 1935; three, Jyekundo, April 13, 1935. Wing measurements: 62-67mm.

These specimens are darker, more brick-brown on the chest and belly, richer in color than birds from Kansu, of which I was able to compare a fine series collected by Beick (Berlin Museum). Also the entire upper parts of my specimens are more brownish or olive-gray, while the birds from Kansu show a purer gray on the backs. The differences can be seen by comparing two series, but they are hardly to be distinguished if one has

only one or two specimens on hand. Altogether, the difference is very slight, not offering evidence enough to justify a new subspecific name. However, this is another example which shows that Khams (Chinese Tibet) birds, which live in a damper climate, are darker as a rule, than their representatives in Kansu.

A quite rare bird living in small parties, often together with flocks of *Leptopoeile sophiae obscura*, in the highest dwarf scrub region of Khams and Tibet. It is not present in the alpine region of the subtropical Hsifan mountains. (E. S.)

***Parus palustris dejeani* (Oust.)**

Parus dejeani Oustalet, Bull. Mus. Paris, III, p. 20, 1897. (Tatsienlu.)

One male, Leh, near Batang, Yangtse river, November 19, in full winter plumage. Wing measurement: 62 mm.

I found this extremely rare bird only once in the Yangtse river gorge, south of Batang, at an altitude of 2750 meters. It seems to live only in the deep river canyons and does not ascend to the mixed forest of higher Tibetan mountain regions; nor does it seem to penetrate far into Tibet. (E. S.)

***Parus atricapillus weigoldicus* (Kleinschmidt).**

Faleo, p. 3, 1931. (Mekong Region: Mauntschi, Yaneti, Atentsze, Tatsienlu, Sungpan, eastern Tibet.)

Four males, three females, Tunggnolo (Camp 6), September 11, 12, 13, 1934; two females, Malashi, south of Litang, October 10, 1934; one female, Shari La (Garila) near Batang, January, 1935; one pair, January 28, 1935; one unsexed specimen, Camp 54, February 18, 1935; one unsexed specimen, Camp 90, May 25, 1935; one male, near Seshu (Camp 139), September 1, 1935. The specimen from Camp 90, breeding; all the rest, in full winter plumage.

Wing measurements: males 66-69 mm.; females 66-69.5 mm.; unsexed 67-68 mm.

Quite common in eastern Tibetan territory, where it lives in small bands along the river beds in thickets of willows or in mixed deciduous and coniferous forests at rather low altitudes not ranging as high as the timberline. The parties of these tame little birds are occasionally joined by other species, such as *Parus major tibetanus* or *Aegithaliscus bonvaloti bonvaloti*. (E. S.)

***Aegithaliscus bonvaloti bonvaloti* (Oust.)**

Aeredula bonvaloti Oustalet, Ann. Sci. Nat., Zool., (7), XII, p. 286, pl. Togul 9, fig. 1, 1891. (Tatsienlu and Pendjama, Szechuan.)

Four males, Mili Ting, near Batang, October 24, 1934; in fine winter plumage.

One female same locality and date; two females, Leh, south of Batang, Yangtse river, November 19, 1934. All these birds are in fine winter plumage.

Wing measurements: males 60-61.5 mm.; females 60-62 mm.

Not too common but widely distributed over the Hsifan mountains and wooded regions of Khams, where it occurs in mixed deciduous and coniferous forests. It is fond of the willow thickets, poplars, and heavy underbrush in the stream-beds, avoiding the pure coniferous woods, as well as the high alpine region near or above the timberline. It prefers the lower regions between 1500 and 3500 meters and also does not seem to penetrate far into Tibet. I found this lively, gregarious, little bird mostly in the tributary valleys of the Tung, Yalung and Yangtse rivers. (E. S.)

***Suthora webbiana alphonsiana* Verr.**

Suthora alphonsiana Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 35, 1870. (Thibet chinois.)

Five males and one immature female, Waszekou, August 19, 1934, on the Tung river. The males measure 50-51.5 mm. in the wing. All these specimens are in moult.

My specimens from Waszekou, 1700 meters above sea-level, compared to Weigold's birds from Kwanhsien and Tungwan, are purer in color and much lighter on the throat and underparts. They correspond to the original description of the bird and are certainly true *alphonsiana*, while Weigold's birds, though they are certainly referable to *alphonsiana*, still seem to be intermediate between *suffusa* and *alphonsiana*, at least to a very slight degree. There seem to be all phases and stages of color between the two races, with a tendency to become lighter in color as they penetrate the Hsifan mountains.

These birds are distributed over the dry erosional valleys of the Hsifan mountains but not entering physiogeographical Tibetan country.

Quite plentiful in the arid valley of the Tung where they occur in large parties of ten to forty birds, preferring the dry, grassy slopes along the mountain sides. (E. S.)

***Suthora webbiana suffusa* (Swinh.)**

Suthora suffusa Swinhoe, Proc. Zool. Soc. London, No. 24, p. 372, May 2, 1871. (Upper Yangtse.)

One female, with wing feathers moulting, Yachow, August 10, 1934.

Stresemann demonstrated with Weigold's large series collected along the Yangtse river from Hankow up to the Red Basin of Szechuan, that *suffusa* and *alphonsiana*, which, because of their morphological differences, were formerly considered to be different species, are only races of the same species. Both races interbreed along the border of the Szechuan Red Basin and the high Hsifan mountains.

I found this race inhabiting only the subtropical Red Basin of Szechuan, interbreeding with *alphonsiana* near Kwanhsien and Yachow, but not entering the mountains, where it is replaced by *Suthora webbiana alphonsiana*.

These birds are very gregarious but are never found with other species of birds; they are very fond of dry grass, scrub, and low bamboos. (E. S.)

SITTIDAE

***Sitta europaea sinensis* Verr.**

Sitta sinensis Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 34, 1870. (Kiukiang.)

One pair, Yachow, August 7, 1934. Wing length: male 67.5 mm.; female 74 mm.

This form ranges over the subtropical lowland regions of Szechuan and the Red Basin but does not enter the mountainous parts of the Hsifan region, where *Sitta europaea nebulosa* takes its place. Fairly common resident around Chinese villages, farmhouses, parks, and temple gardens with tall trees. (E. S.)

***Sitta europaea nebulosa* La Touche.**

Bull. B. O. Club, XLII, No. CCLXIV, p. 55, Jan. 3, 1922. (Milati, Yunnan.)

One adult male, Hokow, September 14, 1934; seven adult males in full winter plumage, Batang, and vicinity, October 4, 1934 and December 6, 1934. Two adult females from the same locality, October 24, 1934 and November 15, 1934. One male, near Beyü, February 1935.

Wing measurements: males 82.5-89 mm.; females 87-88 mm.

Widely distributed over the mountains of Khams. Does not inhabit coniferous forests. Quite common in the neighborhood of Tibetan villages where it is very often seen on the poplar and walnut trees in the bottom of the valleys, in small parties of two to five birds; in wintertime often found with titmice or Pied Woodpeckers. (E. S.)

***Sitta canadensis yunnanensis* O. Grant.**

Sitta yunnanensis Ogilvie Grant, Bull. B. O. Club, X, p. XXXVII, 1900. (Weiyuan, southern Yunnan.)

Two adult females, Hokow, September 13, 1934; wing length: 69.5 and 71 mm.

This bird seems to be restricted to the tributaries of the great south-flowing rivers, Yalung, Yangtse, and possibly Mekong, which form the passageways for all the subtropical Yunnanese elements of the fauna of Khams. I never found this bird farther north than Hokow. It prefers the drier pine forests and avoids the dense palaearctic spruce and fir woods. (E. S.)

***Sitta leucopsis przewalskii* Berezowski and Bian.**

Sitta przewalskii Berezowski and Bianchi, Exped. Potanini Gansu, Aves, p. 119, 1891. (Ober Chuanchen.)

One adult male in fresh winter plumage, Malashi (Camp 18), south of Litang, October 10, 1934. This specimen has a wing length of 75 mm.

One of the shyest and rarest denizens of the thick, coniferous forests of Khams it is found only in the palaearctic region and does not occur in the Hsifan mountains. It leads a solitary life just as *Picooides funebris* does, in the same dark spruce and fir woods at altitudes of about 3500 to 4000 meters. (E. S.)

CERTHIIDAE

***Certhia familiaris khamensis* (Bianchi).**

Sharpe, Hand List Birds, IV, pp. 355, 360, 1903. (Kham and upper Mekong.)

One adult male near Hsignolo (Camp 13), September 18, 1934; one male, Malashi, south of Litang (Camp 10), October 1, 1934; two adult males, Batang, (Mili Ting) October 24, 1934; one unsexed specimen, Camp 89, south of Jyekundo, May 15, 1935.

Wing measurements: males 70-71 mm.; unsexed 69 mm.

Resident of the fir and spruce forests of Khams, not common but widely distributed. The bird is mostly met in the company of other species, such as titmice (*Regulus regulus himalayensis* or *Lophobasilus elegans*). (E. S.)

***Certhia himaiyensis yunnanensis* Sharpe.**

Bull. B. O. Club, 13, p. 11, 1902. (Shayang, W. Yunnan.)

Two males, Hokow, September 13, 1934; one female, Dawo, September 1935; one male, Batang, November 19, 1934.

Wing measurements: males 73-77 mm.; female 69.5 mm.

This bird seems to range not quite as far northwest as *Certhia familiaris* but keeps closer to the Himalyan mountain ranges, where it is common in the coniferous zone above the jungle line (in the Hsifan mountains). (E.S.)

***Tichodroma muraria nepalensis* Bp.**

Tichodroma nepalensis Bonaparte, Consp. Gen. Av., I, p. 225, 1825. ("ex Asia centr.")

Two adult males, Litang, October 10, 1934; three males, Batang, November 30, 1934; five adult males, Jyekundo and vicinity, April 1, 4, 14, 16, 1935 in breeding plumage, and one immature male, same locality, August 5, 1935; one male and one unsexed specimen, Seshu, August 28, 1935; one male, Denko, February 22, 1935.

Adult specimens, wing measurement: 105-112 mm.; width of the apex of the outer tailfeather: 9.5-12 mm.

I find all my specimens clearly distinguishable from European wall creepers, agreeing with the observations of Kipp (Anz. Ornith. Ges. Bay., 12, p. 129, 1928), who states that the Asiatic birds have much larger white tips on the outer tail feathers and have a very distinct reddish color on the upper base of the tail feathers. Besides this, I found that the apex of the outer tailfeathers is much wider (9.5-12 mm.) in Asiatic specimens, as against only 7-10 mm. in European representatives, of which I had a large series for comparison on hand. I therefore refer all my specimens to this race.

The wall creeper is not uncommon in the rocky part of the Hsifan mountains ranging over the alps of Khams northward to Chinghai, Tibet. It seems to be especially fond of rugged limestone cliffs, being independent

of altitudes. It avoids the wooded regions but might be found in the deep-cut river gorges, as well as in the high alps above the timber line. (E. S.)

TIMALIIDAE

Garrulax maximus (Verr.)

Pterorhinus maximus Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 36, pl. 3, fig. 1, 1870. (Tibet.)

A series of seven males, two females and three unsexed birds from the upper Tunggnolo valley, Tunggnolo (Camp 5), Batang and Beyü (Camp 46), taken during the months of February, September and November.

This series is very variable as to the color of the tail, and the amount of spotting on the underparts. The intensity of the rusty color of the underparts also varies considerably.

The wings of the males range between 134.5 mm. and 142 mm. The two females measure 132 mm. and 134 mm. (R. M. S.)

Garrulax lanceolatus lanceolatus (Verr.)

Pterorhinus lanceolatus Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 36, 1871. (Tibet.)

A fine series from Wangmu, Mili Ting, Leh, Batang, Sho Tang (Camp 44) and Beyü (Camp 46), collected during February, August, October, November and December. The wings of the males measure 108 mm. to 115 mm., and those of the females 104 mm. to 115 mm.

The August birds are in very worn plumage.

Two birds from Leh correspond to the description of *bonvaloti* but a third bird from the same locality matches the rest of the series.

Berlioz (L'Ois., p. 10, 1930), gives the wing measurement for *G. lanceolatus lanceolatus* as 95 to 105 mm., while Hartert's eight specimens (Vög. Pal. Faun., I, p. 628) measured 94 to 110 mm. These birds collected by the Dolan expedition therefore seem exceptionally large. (R. M. S.)

Garrulax elliotii elliotii (Verr.)

Trochalopteryx elliotii Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 36, 1870. (Tibet.)

A good series of birds was secured at Sanchopin, Tatsienlu, Mili Ting, Beyü (Camp 46) and Leh, during February, August, September, October and November.

A specimen secured in September at Tatsienlu is immature and similar in plumage to the adults. The wings of the males measure 92 mm. to 105 mm., those of the females 93 mm. to 97 mm. (R. M. S.)

Garrulax perspicillatus perspicillatus (Gm.)

Turdus perspicillatus Gmelin, Syst. Nat., I, 2, p. 830, 1789. (China.)

One female with a wing of 131 mm. was secured at Yachow. The bird is slightly browner than a series from northeast China. (R. M. S.)

Garrulax sannio Swinh.

Garrulax sannio Swinhoe, Ibis, p. 403, 1867. (Amoy, China.)

Five specimens from Chengtu taken in July. (R. M. S.)

Pomatorhinus macclellandi dedekensi Oust.

Pomatorhinus macclellandi var. *dedekensi* Oustalet, Ann. Sci. Nat., XII, p. 304, 1891. (Tso Nghai, Tibet, and Tatsienlu, Szechuan.)

A good series of this bird was secured at Sho Tang (Camp 44), Sama (Camp 41), and Leh, during January, February, and November. The wing range is 86 mm. to 101 mm. (R. M. S.)

Pomatorhinus ruficollis, subsp.

This is a very richly colored specimen; the color is a cinnamon brown. In color it is closest to *P. r. ruficollis* of Nepal.

One male, with a wing of 77.5 mm. was secured August 5, at Yachow, but it is badly damaged. (R. M. S.)

Stachyris ruficeps davidi (Oust.)

Stachyridopsis davidi, Oustalet, Bull. Mus. Paris, 5, p. 119, 1899. (Szechuan.)

Two males and a female in very worn plumage secured in July at Chengtu. (R. M. S.)

Alcippe nipalensis hueti David.

Alcippe hueti David, Ann. Sci. Nat., XIX, art. 9, p. 4, 1874. (West Fohkien.)

Three males and one unsexed bird, all very worn, taken at Chengtu and Chungchow during July and August. (R. M. S.)

Proparus vinipectus bieti (Oust.)

Alcippe (Proparus) bieti Oustalet, Ann. Sci. Nat., (7), XII, pp. 283, 304, pl. IX, fig. 2, 1892. (Tatsienlu, Sikong.)

Two males, Tatsienlu, October 10, 1935; four males, one female, and one unsexed specimen, Batang, November 17, 1934. All birds in fine winter plumage.

Wing measurements: males 57-63 mm.; female 57 mm.; unsexed 61 mm.

This lively little bird inhabits the lower regions of all the prickly oak forests. In higher regions *Proparus striaticollis striaticollis* takes its place. These birds travel about in small parties and are very tame, sometimes approaching the observer as closely as a yard or two, if he stands absolutely still. (E. S.)

Proparus striaticollis striaticollis (Verr.)

Siva striaticollis Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 38, 1870. (Montagnes du Thibet chinois.)

One pair, Tatsienlu, October 3, 1935; one male Tunggnolo (Camp 6), September 12, 1934; two males, one female, Batang (Mili Ting), October 24, 1934. All specimens apparently in full winter plumage, are referable to true *striaticollis*.

Wing measurements: males 57-64 mm.; females 58.5-62.5 mm.

This bird is much hardier than *Proparus vinipectus*; it lives commonly at higher elevations and also seems to penetrate Tibet farther to the north, but it is found only in the prickly oak belt (*Quercus ilex*), though one sometimes finds the bird in rhododendron or other brush. The bird frequents thick undergrowth, where it takes refuge when disturbed or frightened. (E. S.)

Moupinia poecilotis poecilotis (Verr.)

Alcippe poecilotis Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 35, 1870. (Moupin.)

Two males from Tunggnolo (Camp 5) and another specimen from 25 miles east of Hokow taken in September and October. (R. M. S.)

Yuhina diademata diademata Verr.

Yuhina diademata Verreaux, Nouv. Arch. Mus. Paris, V, Bull., p. 35, 1869. (East Tibet.)

Two males in fearfully worn plumage taken at Hwalinpin and Chingehhsien in August. (R. M. S.)

Leiothrix lutea lutea (Scop.)

Sylvia lutea Scopoli, Del. Flor. et Faun., Insubr. II, p. 96, 1786. (China.)

Two males taken in Hwalinpin in August. (R. M. S.)

PYCNONOTIDAE

Spizixos semitorques semitorques Swinh.

Spizixos semitorques Swinhoe, Ibis, p. 266, 1861. (Pehling Dateau, Foochow.)

Five specimens from Chengtu and Yachow secured in July and August. (R. M. S.)

Pycnonotus xanthorrhous xanthorrhous J. Anderson.

Pycnonotus xanthorrhous Anderson, Proc. As. Soc. Beng., p. 265, 1869. (Manwyne, Yunnan.)

A series of eleven birds from Leh all taken November 19. The wings of the birds vary between 86 mm. and 94 mm. They are in fresh plumage. (R. M. S.)

Pycnonotus xanthorrhous andersoni (Swinh.)

Ixus andersoni Swinhoe, Ann. and Mag. Nat. Hist., p. 75, 1870. (Ichang, China.)

Five birds from Nitou and three from Yachow, in worn plumage are altogether paler, especially the band across the chest, than the specimens from Leh.

It does not seem probable that the paler coloration is due entirely to wear, and therefore I have ascribed these birds to the above race.

This series was taken toward the middle of August. The wings measure between 86 mm. and 94 mm. (R. M. S.)

***Pycnonotus sinensis sinensis* (Gm.)**

Muscicapa sinensis Gmelin, Syst. Nat., I, pt. II, p. 942, 1788. (China.)

A small series was secured at Chengtu and Yachow in July and August. The wing range is 85 mm. to 91 mm. (R. M. S.)

CINCLIDAE***Cinclus cinclus przewalskii* Bianchi.**

Bul. B. O. Club, XV, p. 91, 1905. (East Tibet.)

Thirty-two specimens of the light, twenty-five of the dark variety, the latter being restricted to the high, Tibetan, steppe country. The following examples were closely examined:

A. White-breasted Race:

One male, Cheto (Camp 2), September 9, 1934; one male, two females, Batang, January 5, 1935; seven males, three females, vicinity of Beyü, February 5, 7, 1935; one male, two females, Jyekundo, April 3, 1935; two immature birds, Jyekundo, June 8, 1935.

B. Dark Race:

Five males, five females, Buho (Camp 53), February 23, 1935.

Wing measurements: dark variety, ten males 95-102 mm.; thirteen females 85-98.5 mm.; light variety, twenty males 95-103.5 mm.; twelve females 87-95 mm.

The light variety is common in the Hsifan mountains and in the wooded regions of Khams (Chinese Tibet) becoming rarer north of the timberline, where it frequents the larger rivers and streams. The dark variety however, forming an ecological race, is not found in the Hsifan mountains or in the wooded region of Tibet, but seems to be restricted to the northern steppe country, its range beginning north of Derge. There it far outnumbered the light-colored race. (E. S.)

***Cinclus pallasii souliei* Oust.**

Cinclus pallasii var. *souliei* Oustalet, Ann. Sci. Nat., Zool., (7), XII, p. 299, 1891. (Tatsienlu and Moupin.)

One adult female, Waszekou, August 8, 1934; one adult male in winter plumage, near Batang, January 5, 1935; one pair in winter plumage, Derge, February 11, 1935; both adult birds.

Wing measurements: males 109 mm.; females 107-109 mm.

The South China Dipper is not uncommon along the streams and rivers of the Hsifan mountains and in the wooded parts of Khams, Chinese Tibet. Its limit of distribution is formed by the northern timberline. It is a very skillful fisherman and swimmer; being quite shy, it is difficult to secure specimens on the foaming torrents of its habitat. The bird does not penetrate Tibet as far as *Cinclus cinclus przewalskii* and also is not found above the timberline. (E. S.)

TROGLODYTIDAE

Troglodytes troglodytes szetschuanus Hartert.

Vög. Pal. Fauna, I, Heft 6, p. 783, June 1910. (Tsingling Berge und Szechwan.)

Eight adult males, Batang, all in winter plumage, October 26, 27, December 19, 1934; one male, near Denko, February 23, 1935; one female, Camp 26, October 19, 1934; one unsexed specimen, Beyü, February 7, 1935.

Measurements: wing 51-56 mm.; tail 27-31 mm.

All examples are in full winter plumage.

The West China Wren is not an uncommon resident of all the wooded regions of the Hsifan mountains and of Khams. I also found it in the Yalung steppe country near Seshu, in the dwarf scrub region. It is very fond of running water, thick cover, and much undergrowth.

A very hardy non-migratory bird, easily able to stand the great cold of the Tibetan winter. (E. S.)

TURDIDAE

Saxicola torquata yunnanensis (La Touche).

Pratincola torquata yunnanensis La Touche, Bull. B. O. Club, XLIII, p. 134, 1923. (Yunnan.)

Two females of this smaller race from the Tung valley, Hsifan mountains, Lutingkiao, Sanchopin, August 15, 18, 1934, measure 66 mm. and 67.5 mm. in the wing. They are apparently young birds, more rusty on the back and rump than *przewalskii*.

This race of Bush Chat, the range of which extends farther to the south, does not occur in Tibetan country but seems to be restricted to the warmer subtropical valleys of the Hsifan mountains. Here it frequents the arid river valleys, where bushes and xerophil scrub vegetation prevail in small numbers. It seems to be especially fond of the agricultural zone with artificial irrigation-works. Its common habitat is formed by the maize fields, the birds sit on the tops of the tall corn stalks watching for prey, which they often catch flying like Muscicapidae.

This race is not quite as abundant as *Saxicola torquata przewalskii*. (E. S.)

Saxicola torquata przewalskii (Pleske).

Pratincola maura var. *przewalskii* Pleske, Wiss. Res. Przew. Reisen, Vögel, I, p. 46, pl. IV, figs. 1, 2, 3, 1889. (Kansu.)

One male, Camp 3 near Tatsienlu, September 10, 1934; six males, two females in full breeding plumage, Camp 76 near Jyekundo, April 15, 1935; two unsexed juvenal birds, Camp 137, August 11, 1935.

Wing measurements: adult males 74-77.5 mm.; adult females 72.5-75 mm.; immature birds 72-73.5 mm.

A migratory bird, commonly found in physiogeographical Tibetan country, its range extending from Tatsienlu west and northwestward, it inhabits the wide shallow valleys above and north of timberline, its breeding grounds lying in the dwarf willow and dwarf rhododendron zone mostly between 3800 and 4500 meters. In autumn the bird comes lower down into the agricultural districts, migrating along the trenches of the main river courses, avoiding the dense tall forests. It does not occur on the steppes or in the high alpine region. Solitary during the breeding season; in small parties while migrating. The males arrive in spring a few days earlier than the females. *Cuculus canorus* is a common breeding parasite of this bird. (E. S.)

***Saxicola insignis* Blyth.**

Saxicola insignis Hodgson, Gray's Zool. Misc., p. 83, 1844.

Pratincola insignis Blyth, Journ. As. Soc. Bengal, XVI, p. 129, 1847. (India.)

Six adult males, all in full breeding plumage, Camp 79, Drechu Gomba, May 2, 1935. Wing measurement: 88-91.5 mm.

Though I observed with care, I was unable to find any evidence of this bird breeding in Tibet. In spring it seems to migrate along the Yalung and Yangtse rivers stopping here and there for a few days' rest. I found the bird in undulating country along the mountain slopes or in the swampy valleys of the Kiang steppe. It proved to be very shy, taking flight at distances of 50 to 100 yards, making collecting very difficult. (E. S.)

***Rhodophila ferrea haringtoni* (Hart.)**

Oreicola ferrea haringtoni Hartert, Vög. Pal Fauna, 1, 6, p. 711, 1910. (Lienkiang near Fuchow.)

Three pairs were secured during August at Nitou, Sanchopin, Hwalinpin and Lengchi. Wings 62-64 mm. (R. M. S.)

***Oenanthe deserti oreophila* (Ober.)**

Saxicola oreophila Oberholser, Proc. U.S. Nat. Mus., XXII, p. 221, 1901. (Tibet.) (New name for *S. montana*.)

Four adult males, one adult female and four immature birds, Camp 121, wild yak steppe, July 5, 1935.

Wing measurements: adult males 95-99 mm.; adult females 96 mm.; immature birds 86-96.5 mm.

I found this bird only in the highest unpopulated Tibetan country on the banks of the Drechu and Chumar (source rivers of the Yangtsekiang). It inhabits desolate semi-deserts and barren ground where it breeds in loess walls and deep river-cut erosion gutters or wind-blown dirt channels. Though these birds bred in countries free from human habitation, they proved to be extremely shy and timid. It was very difficult to secure specimens in this absolutely open country. A rare bird, the range of which does not seem to extend farther to the east. (E. S.)

***Phoenicurus frontalis* Vig.**

Phoenicurus frontalis Vigors, Proc. Committee Zool. Soc. London, I, p. 172, 1832. (Himalayas.)

One male, Tatsienlu, October 3, 1935; one immature male, Litang, October 12, 1934; three males, one female in winter plumage, Batang, October 24, 1934; two adult males, Camp 78, April 17, 1935; one unsexed immature specimen and one immature female, Jyekundo, August 11, 1935.

Wing measurements: adult males 87-93 mm.; females 81-82 mm.

This Blue-fronted Redstart inhabits the Hsifan mountain ranges as well as the alpine region of Tibet, going as far north as Jyekundo. The bird has semi-migratory habits, wintering in the hilly parts of the Red Basin of Szechuan, in Yunnan, and the lower valleys of the Khams mountain region. Its breeding grounds are formed by the alpine dwarf scrub zone in altitudes higher than 4000 meters. The bird is shy, taking flight at a distance upon the approach of a human being. (E. S.)

***Phoenicurus schisticeps* Gray.**

Phoenicurus schisticeps "Hodgson" Gray, Gray's Zool. Misc., p. 83, 1844. (Nepal.)

One adult male, Tunggnolo, September 12, 1934; one adult female, Hokow, September 14, 1934; one adult male and an immature male in postjuvinal moult, Hsignolo, September 20, 1934; two adult males, Litang, September 29, and October 18, 1934; seven adult males, five adult females, all in winter plumage, surroundings of Batang, October 24, 1934, November 13, 20 and December 6, 28, 30, 1934; two adult males, Beyü, February 7, 1935; one pair in breeding plumage, Camp 75, April 14, 1935.

Wing measurements: adult males 82-87 mm.; adult females 79-82 mm.

This species of redstart belongs to the entire Tibetan woodland region. It is very hardy, migrating in winter, mostly in vertical direction, taking refuge from the intense cold in the deeply cut erosional valleys or in the subtropical parts of the Hsifan mountains. In the breeding season it avoids the arid gorges as well as the high alpine region and is never found in the high steppe country. (E. S.)

***Phoenicurus aureora aureora* (Pall.)**

Motacilla aureora Pallas, Reise Versch. Prov. Russ. Reichs, III, p. 695, 1776. (Selenka, Lake Baikal.)

One male in full moult, Nitou, Tung valley, Hsifan mountains, August 14, 1934, wing 74 mm., tail 57 mm.; and another male in fresh winter plumage, Tatsienlu, October 3, 1935, wing 74 mm.; tail 58 mm.

One male in very much worn plumage, Jyekundo, Chinghai, upper Yangtse river, May 15, 1935. This specimen measures: wing 76 mm.; tail 62 mm. and might be referred to the larger race *Phoenicurus aureora filchneri* Parrot (Filchner's Exped. China-Tibet, Zool.-Bot. Erg., p. 130, 1907, Kansu).

This redstart is commonly found in the Hsifan mountains, wintering in large numbers in the Szechuan Red Basin. It is very rare in physiogeographically Tibetan territory, where I found it only near Dawo and Jyekundo. Because of the lack of material I am unable to settle the question whether the Tibetan birds really belong to a larger race or not. (E. S.)

***Phoenicurus ochruros rufiventris* (Vieill.)**

Oenanthe rufiventris Vieillot, Nouv. Dict. d'Hist. Nat., Nouv. ed., XXI, p. 431, 1818. (India.)

Eleven adult males in full breeding plumage and ten adult females, Jyekundo and vicinity, Chinghai, upper Yangtse river, April 3, 9, 12, 14, 15, 1935; three immature males in worn plumage, from the same locality, April 12, 13, 15, 1935; two immature males in juvenal plumage, same locality, June 9, 1935, (wing measurements: 71-73 mm.); one immature male in postjuvénal moult, same locality, August 28, 1935, (wing 84 mm.).

Wing measurements: adult males 87-90 mm.; adult females 81-85 mm.; worn males 82.5-85.5 mm.

The range of the Tibetan House Redstart begins north of the timberline, where the bird inhabits the northernmost agricultural districts and the broken-up steppe regions. It does not occur on the wild yak steppe but follows the gorge of the Yangtse river northward to the bifurcation of the Chumar and Drechu. It never breeds on houses, but oftentimes breeds in loess walls, on steep river banks, and in cliffs. (E. S.)

***Phoenicurus erythrogaster maximus* Kleinschmidt.**

Abh. u. Ber. Mus. Tier-u. Völkerk. Dresden, XVI, Nr. 2, p. 42 (Janeti, Rombadsa and Chuwo, Sikong.)

Seven adult males in winter plumage, Litang, October 10, 1934; two females, mountains east of Batang, October 23, 1934 and January 22, 1935; three males, two females, Jyekundo, Chinghai, upper Yangtse, April 13, 1935; one immature male in postjuvénal moult, Seshu, August 31, 1935.

Wing measurements: adult males 103-110 mm.; adult females 101-104 mm.; immature male 101 mm.

Seventeen males from North Kansu (Berlin Museum) measure 101-108 mm. in the wing, while the eleven females from the same locality measure 96.5-101 mm. Apparently high Tibetan birds are slightly larger than the birds from Kansu province of western China. Being unable to find any marked distinction in color, I am convinced that the Kansu birds hardly warrant recognition by a new subspecific name.

This largest of the numerous Tibetan species of redstarts is not uncommon in the highest mountains of physiogeographical Tibet, west and northwest of Tatsienlu, its range extending northward to the mountains of the wild yak steppe. It does not occur in the Hsifan mountains. The

males are very hardy, remaining in winter in the cold Tibetan mountain districts, while the females migrate to the south. (E. S.)

***Chaimarrornis leucocephala* (Vig.)**

Phoenicurus leucocephala Vigors, Proc. Committee Zool. Soc. London, I, p. 35, 1831. (Himalayas.)

Two adult males and one female, all badly moulted, Tung valley, Hsifan mountains, near Lutingkiao, August 15, 1934; and a pair of immature birds, same locality and date. One adult male in fresh winter plumage, Tunggnolo, September 13, 1934; one adult female, Hsignolo, September 22, 1934; one adult male in breeding plumage, Jyekundo, May 19, 1935.

Wing measurements: adult males 97-105 mm.; adult females 97 mm.

The White-capped Water Redstart is more widely distributed than the Plumbeous Redstart, ranging from the Hsifan mountains, where it even frequents the icy glacier streams above the timberline, through the whole province of Sikong up to Jyekundo, on the Yangtse river. Generally it is shyer than *Chaimarrornis fuliginosa*. One of the most striking birds along all kinds of water courses. (E. S.)

***Chaimarrornis fuliginosa fuliginosa* (Vig.)**

Phoenicurus fuliginosa Vigors, Proc. Committee Zool. Soc. London, I, p. 35, 1831. (Himalayan mountains.)

One adult male, Nitou, Hsifan mountains, August 14, 1934 (wing measurement: 84 mm.); one juvenal unsexed bird, Hoangnipu, Hsifan mountains, August 11, 1934; another unsexed immature bird, Waszekou, August 8, 1934; an immature female, Tatsienlu, October 3, 1935.

The Plumbeous Redstart lives along streams and rivers in the Hsifan mountains and in Sikong, Chinese Tibet. It does not penetrate far into the interior. The bird has semi-migratory habits, wintering in great numbers along the rivers of the Red Basin of Szechuan. It is a common bird, mostly found in the same localities as *Cinclus cinclus* or *Cinclus pallasii*. Generally it does not go as high up as *Chaimarrornis leucocephala*; it is not found above the timberline. (E. S.)

***Luscinia pectoralis tschebaiewi* (Przew.)**

Calliope tschebaiewi Przewalski, Mongol i Strana Tangut, 2, p. 44, 1876; Rowley, Orn. Misc., II, 6, p. 180, pl. 54, 1877. (Mountains of Kansu.)

Five males, one female in full breeding plumage, Camp 90 near Jyekundo, May 17, 1935; one adult male, in moult, Camp 139, August 31; one adult, three young males in postjuvinal moult, Camp 140, September 1, 1935.

Wing measurements: adult males 76-82 mm.; juvenal males 75-76.5 mm.; female 71 mm.; together 71-82 mm.

With the young males in postjuvinal moult, the ruby throat feathers are just appearing.

One of the most characteristic migratory birds of the high Tibetan dwarf-brush region above and north of the tree limit. A shy bird, mostly living in thick brush in altitudes between 3500 and nearly 5000 meters. The males have a very fine song, given forth from the vantage point of brush or shrub. (E. S.)

***Grandala coelicolor florentes* Bangs.**

Proc. New Engl. Zool. Cl., IX, p. 78, Nov. 1936. (Szechuan.)

Four males, four females, all adult birds in full winter plumage, Camp 42, January 31, 1935.

Wing measurements: males 142-145 mm.; females 136-141 mm.

Through the courtesy of Mr. Peters, I was able to measure specimens from Sikkim, in the Museum of Comparative Zoölogy at Harvard. I also had the opportunity to study two skins from Nepal in the Academy of Natural Sciences of Philadelphia. Though Mr. Bangs had only a pair of winter birds from Sikkim and another one taken in June from Szechuan before him, when he described *florentes*, I am now able to state that *florentes* is not, as Stone supposed, a synonym of *coelicolor* but a good race, being darker, duller, and smaller than *Grandala coelicolor coelicolor* from the true Himalayan mountains.

The bird is extremely gregarious even during the breeding season. It inhabits the highest mountain region above the timberline in Hsifan and Sikong, but in winter large flocks are found in the lower valleys where they live on berries. (E. S.)

***Tarsiger cyanurus praticus* (Bangs and Phill.)**

Ianthia practica Bangs and Phillips, Bull. Mus. Comp. Zoöl. Harvard, LVIII, p. 292, 1914. (Loukouchai, Yunnan.)

Three males: one, Malashi, October 10, 1934; two, Batang, November 14, 1934. Three females: two Malashi, October 10, 1934; one, Batang, November 14, 1934. One unsexed specimen, Batang, November 14, 1934. All birds in fine fresh winter plumage.

Wing measurements: males 80-85 mm.; females 76-81 mm.; unsexed specimens 82.5 mm.

This bird inhabits the humid coniferous forest of Hsifan and Tibet from 2000 to 4500 meters. It loves undergrowth, and is rarely seen as it is very timid. It does not seem to penetrate far into Tibet. (E. S.)

***Copsychus saularis saularis* (L.)**

Gracula saularis Linnaeus, Syst. Nat., ed. XII, I, p. 165, 1766. (Asia-Bengal.)

A pair of adults and a juvenal male of the Dyal were secured at Chengtu in July. (R. M. S.)

***Turdus merula mandarinus* Bp.**

Turdus mandarina Bonaparte, Consp. Gen. Av., I, p. 275, 1850. (China.)

Two males and a female, all juvenals were secured in July at Chengtu. (R. M. S.)

***Turdus rubrocanus gouldi* (Verr.)**

Merula gouldi Verreaux, Nouv. Arch. Mus. d'Hist. Nat. Paris, VI, Bull., p. 34, 1871.
(Montagnes du Thibet chinois.)

One male, Malashi, south of Litang, October 3, 1934; two females, same date and locality, and one female, Batang, November 2, 1934.

Wing measurements: male 144.5 mm.; females 144-145 mm.

The specimens from Malashi are still in moult, though there is no juvenal specimen among them. Gould's Gray-headed Ouzel replaces *Turdus kessleri* Przew. in the wooded regions of Chinese Tibet and the Hsifan mountains. In the latter area it only lives above the subtropical jungle region in palaearctic, coniferous woods (*Abies delawayi*). Between 2800 and 4600 meters, not at all common; seems to be fond of moist and rather thickly wooded regions. Does not penetrate into Tibet as far as *Turdus kessleri*. (E. S.)

***Turdus naumanni eunomus* Temminck.**

Pl. Col., 514, 1830. (Japan.)

One unsexed specimen from the Tsong Ben La pass, Camp 28, near Batang, October 22, 1934.

The wing of this specimen measures 130 mm.

Found with *Turdus ruficollis ruficollis* Pall. This bird is a shy but common winter visitor of high elevations (4000-4600 meters), where it frequents the tree limit on the dry mountain slopes in order to feed on the seeds of large juniper trees. Often the two thrushes are found in company with *Mycerobas carneipes*. (E. S.)

***Turdus kessleri* Przewalski.**

Mongol i Strana Tangut., p. 62, pl. X, 1876. (Kansu).

Two males, five females, all in fresh winter plumage, Camp 25, between Litang and Batang, October 18, 1934; one female, Jyekundo, March 23, 1935; one female, Jyekundo, August 11, 1935; four males, eight females, all adult and in breeding plumage, Jyekundo, April 13, 1935.

Wing measurements: males 147-156 mm.; females 146-152.5 mm.

Kessler's Thrush is one of the most common residents of the dwarf rhododendron and dwarf willow region along the rocky hillsides above the timberline around 4500 meters. It lives only in Tibetan regions, never occurs in the Hsifan mountains. Living on insects and worms in summer, on berries in the fall, and on seeds of juniper in winter, it descends into lower regions during the latter season. Generally found in flocks of varying size. (E. S.)

***Turdus ruficollis ruficollis* Pallas.**

Reise Versch. Prov. Russ. Reichs, III, p. 694, 1776. ("Hab. in summis jugis Davuriae absitis.")

One male, three females, Tsong Ben La pass, Camp 28, near Batang. One of these females, October 23, 1934, all the others, January 21, 1935.

Wing measurements: 138-140 mm.

This very hardy bird, like *Turdus naumanni eunomus* (Temm.), seems to winter frequently in the high mountainous country of Chinese Tibet (Khams) in altitudes between 4000 and 4600 meters. In spite of the great cold prevailing in these heights the birds do not go lower down, as they feed on juniper berries, which are only to be found along the upper timber-line. Farther in the interior the birds are rare, but near the Szechuan-Yunnan border they are very common in winter. (E. S.)

Turdus dixonii (Seeböhm).

Oreocincla dixonii Seeböhm, Cat. Birds Brit. Mus., V, p. 161, 1881. (Himalaya).

One female from Malashi country, south of Litang, taken October 3, 1934, measuring 137 mm. in the wing, 112 mm. in the tail, bill (from nostril to apex) 16.5 mm.

All characters correspond well to Delacour's description (Ibis, p. 580, 1930); this was confirmed by Dr. Stegmann, who was able to compare the bird with *Turdus mollissimus simlaensis* (Baker) and found that, though the length of the wing is the same, my specimen has a considerably longer tail than *T. m. simlaensis*. Besides this, the chest was less yellow, the entire underparts not as heavily spotted and the spots were not so sickle-shaped as in *T. m. simlaensis*.

Owing to the lack of sufficient material, it is hard to decide at the present time, whether *dixonii* forms a well defined species or whether it will prove to show only subspecific differences as a geographical form of *Turdus mollissimus*. As Delacour had only winter specimens on hand, his statements cannot be looked upon as definite. Stegmann offers the suggestion that "*dixonii*" might represent simply the first adult plumage of *mollissimus* with juvenal primaries, secondaries and tail feathers. Having been unable to find any proof for this, I consider *dixonii* to be a separate species and refer my specimen to it. (E. S.)

Monticola solitarius pandoo (Sykes).

Petrocincla pandoo Sykes, Proc. Zool. Soc. London, p. 87, 1832. (Dense woods of the Ghauts) (Ghats in India.)

Two immature females in postjuvenile moult, Lengchi, August 17, 1934, and Lutingkiao, August 18, 1934, Hsifan mountains, Tung river valley, measuring in the wing 116.5 and 115 mm.

This bird lives only in the dry, river-cut gorges at altitudes between 800 and 2000 meters. It never penetrates the high Tibetan country but sticks to the arid valleys (Min, Tung, Ya, Yalung, Yangtse, Mekong) with zero-phitic vegetation. It is a very agile bird, the favorite habitat of which are the steepest and most inaccessible cliffs along the foaming mountain rivers of Hsifan and Chinese Tibet (Sikong). (E. S.)

Myiophonus temminckii eugenei Hume.

Myiophonus eugenei Hume, Stray Feathers, I, p. 475, 1873. (Thayetmyo, Burma.)

Two males and a female from Batang and Tatsienlu taken in August and December. (R. M. S.)

Prunella collaris nipalensis (Blyth.)

Accentor nipalensis Blyth, Journ. As. Soc. Bengal, XII, p. 958, 1843. (Cachar region of Nepal.)

Five males, one adult, Camp 90, May 17, 1935; four immature, Dzogchen, September 1935. One female, Tsong Ben La, October 22, 1934.

These birds are hardly to be distinguished from specimens in the Dresden Museum (Coll. Weigold).

Wing measurements: adult male 107 mm.; adult female 100 mm.

All my specimens are markedly darker than *Prunella collaris tibetanus*, as Dr. Stegmann, to whom I am indebted for this information, states. Dr. Stegmann says furthermore: "Your specimens are identical with our birds (Academy of Sciences, Leningrad) from N. Szechuan and with two birds from Sikkim. The limit between this race and *tibetanus* goes right across Khams (Sikong), because our examples from Tschamdo belong to *tibetanus*. Therefore it seems that the range of *nipalensis* extends from the eastern Himalayas across southern Khams to Szechuan. However three specimens from Darjeeling (S. Sikkim) are markedly darker and might, according to the description, belong to *ripponi*." I believe that Dr. Stegmann is right in the general outline, but I found that specimens from the Yunnanese alps, as well as those from the Hsifan mountains, were still a little different from *nipalensis*, and might be considered to belong to *ripponi*, which race was originally described from Gyidziushan, Yunnan, W. China.

Resident of the high alpine cliff districts of our entire field of exploration. Not very common in altitudes over 4300 meters but found up to more than 5000 meters. (E. S.)

Prunella immaculata (Hodgs.)

Accentor immaculatus Hodgson, Proc. Zool. Soc. London, XIII, p. 34, 1845. (Nepal.)

One male, Tunggnolo, September 12, 1934, wing 79 mm.

A rare bird inhabiting the thick undergrowth of dense and damp coniferous forests in Sikong (Chinese Tibet); a solitary, shy bird, which seldom utters a call and might be easily overlooked. It seems to be fond of the direct neighborhood of brooks and streams. (E. S.)

Prunella rubeculoides fusca Mayr.

Orn. Monatsber., XXXV, p. 148, 1927. (Szechuan, near Batang.)

Four males: two, Litang, September 24, 1934 and October 6, 1934; one, Batang, November 11, 1934, in winter plumage; one male in breeding plumage, Camp 79, upper Yalung, May 3, 1935. Five females: three, Litang, one September 24; two, October 6, 1934; two, Batang, November

11, 1934; all in winter plumage. One unsexed specimen, Shari La pass, near Batang, January 24, 1935.

Wing measurements: males 78-81 mm.; females 76-78.5 mm.; unsexed specimen 74.5 mm.

I compared these birds with a series of eight, from Sungpan, and another one of eight from northern Kansu and am unable to find any marked differences. On account of this evidence I am inclined not to recognize the race *Prunella rubeculoides beicki* (Mayr).

One of the most characteristic birds of the Tibetan fauna west and northwest of Tatsienlu. It inhabits the dwarf scrub regions but also breeds in the steppe country nearby. Very common bird near Jyekundo and Seshu on the upper Yangtse and Yalung. (E. S.)

Prunella strophciata multistriata (David).

Accentor multistriatus David, Ann. and Mag. Nat. Hist., (4), VII, p. 256, 1871. (Moupin, Western Szechuan.)

This series corresponds to David's description.

Eight males, Batang, October 28, 1934 and Camp 26, east of Batang, October 19, 1934; two females, Hsignolo, September 20, 1934; and Drupalong, south of Batang, January 5, 1935; two unsexed specimens, Tatsienlu, October 3, 1935 and Batang, October 28, 1934; all specimens in fine winter plumage.

Wing measurements: males 66-69 mm.; females 65-67 mm.

Dr. Stegmann, to whom I am indebted for a great deal of information, and I, came independently to the following conclusions: that all specimens from Sikong (Khams), Chinese Tibet, are darker and duller in color than birds from Nanshan, Kokonor, and Kansu (also Sungpan, district of northern Szechuan). The specimens from Sikkim however, are still darker and more colorful, the throats being much more striped with black, the backs browner, the dark markings larger, the color of the head and the superciliar stripe more pronounced, the underparts (belly) having an unmistakable yellowish wash. Therefore, the specimens from Sikkim have to be classified as true *strophciata*. My specimens and all the ones from Sikong (Khams) and the Hsifan mountains, including their southeastermost outpost, the Washan, belong to the intermediate form *multistriata*, the type of which came from Mupin. The Sungpan specimens however, are again intermediate between *multistriata* and the lighter form from Kansu (Beick collection, Berlin Museum), hitherto undescribed. Dr. Stegmann also states that: "die Nord-Kansu Rasse neu beschrieben werden kann."

This bird inhabits the wooded regions of the Hsifan mountains and Sikong (Khams), Chinese Tibet, around the timberline, in winter descending to lower altitudes in the deep river-cut gorges, where the birds congregate and become quite plentiful, but they scatter again at the beginning of the breeding season. (E. S.)

***Prunella fulvescens khamensis* Sushkin.**

Proc. Boston Soc. Nat. Hist., 38, No. 1, p. 54, 1925. (Kham, Sikong, eastern Tibet.)

Four males, two, vicinity of Batang, January 14, 24, 1935, and two from Beyü, February 6, 1935. Five females, one, Camp 26, east of Batang, October 1934; two, Batang, November 20, 1934; two, Beyü, February 6, 1935. All these specimens are in fine winter plumage. One immature bird, Jyekundo, August 8, 1935.

Wing measurements: mature males 74-75.5 mm.; mature females 74-75 mm.

This series of birds, by having the entire upperparts more intensively striated, shows great differences from all specimens in the Berlin Museum from Ala Shan, Turkestan, Ladak, and Kansu.

Through the kindness of Dr. Kinnear and Dr. Stegmann, my supposition for referring all my specimens to *khamensis* was stated.

The bird is widely distributed over the high mountains of southern Sikong and the uppermost gorges of the Yangtse river, near Jyekundo. It belongs entirely to the Tibetan fauna and does not occur in the Hsifan mountains. (E. S.)

SYLVIIDAE***Tribura thoracica przewalskii* (Sush.)**

Dumeticola thoracica przewalskii, Sushkin, Proc. Boston Soc. Nat. Sci., 38, No. 1, p. 41, 1925. (Dschachar mountains, upper Hoang-ho.)

A male from Tashanling secured August 12. (R. M. S.)

***Phylloscopus affinis* (Tickell).**

Motacilla affinis Tickell, Journ. As. Soc. Bengal, II, p. 576, 1833. (Jungles of Borabhum and Dholbum.)

Nine males: Litang, September 24, 1934; Batang, October 27, 1934, all in fresh winter plumage; six specimens in breeding plumage, Jyekundo, May 7, 1935; one specimen, Camp 137, August 11, 1935; three females, Tunggnolo; one, September 13, 1934, two, Batang, October 27, 1934. The specimens from Tunggnolo, Litang, and Batang have yellower underparts, than those from Jyekundo and the one from Camp 137; the latter ones are slightly lighter in color on chest and belly.

Wing measurements: males 59-64 mm.; females 56-62 mm.

This seasonal variation of color possibly may be due to fading.

Tickell's Willow Warbler lives in the highest brush region of Tibet. In winter it descends into the deep erosional valleys, where it frequents the arid zone with thorny brush vegetation (*Prunus*, *Berberis*, *Rosa*, *Cotoneaster*, etc.). A very hardy bird with semimigratory habits, preferring intensely cold regions. (E. S.)

***Phylloscopus subaffinis* (Grant).**

Oreopneuste subaffinis Grant, Bull. B. O. Club, X, p. 32, Jan. 1900. (Puanting, S. W. Kansu.)

One immature pair, Lengchi, Hsifan mountains, August 17, 1934; male 51 mm., female 47 mm., and an adult male in fresh winter plumage, Tatsienlu, October 1, measuring 57 mm. in the wing.

This little Willow Warbler belongs to the subtropical fauna of the Hsifan mountains. According to my observations, it reaches its north-western point of distribution near the Chinese-Tibetan border city Tatsienlu and does not occur in physiogeographically Tibetan country. It is quite common in the arid gorges of the Tung river valley, where it inhabits thorny thickets and can be easily recognized by its rather loud and harsh call, which sounds like "tack, tack." (E. S.)

***Phylloscopus fuscatus robustus* Stresemann.**

Abh. u. Ber. Mus. f. Tierkunde Dresden, XVI, 2, p. 16, 1924. (Sungpan, upper Min valley.)

Three males: one, Hsignolo, September 20, 1934; one, Litang, September 24, 1934; one, Malashi, September 30, 1934. Seven females: two, Hsignolo, September 20, 1934; one, Litang, September 24, 1934; one, Batang, October 27, 1934; two, Malashi, September 30, 1934; one, Camp 145, Dzogchen.

These birds measure 56 to 63 mm. in the wing.

The Dusky Willow Warbler is rather common in the dwarf brush region above the timberline in the Chinese Tibetan borderland. It avoids the wooded regions and seems to be replaced by Weigold's Willow Warbler (*Phylloscopus weigoldi*) in the highest and northwesternmost parts of Sikong, though both birds are found together in the southern and southeastern parts along the border of the Hsifan mountains. (E. S.)

***Phylloscopus armandii armandii* (Milne-Edw.)**

Abrornis armandii Milne-Edwards, Nouv. Arch. Mus. Bull. Paris, I, p. 22, 1865. (Mountains west and northward of Peking.)

Nine males: three, Tatsienlu, October 10, 1935; one, same locality, September 6, 1934; one, Hsignolo, September 20, 1934; two, Batang, October 27, 1934; one, Jyekundo, May 7, 1935. Five females: one, Wangmu, north of Tatsienlu, August 22, 1934; one, Dawo, September 25, 1935; three, Batang, October 27, 1934; two unsexed specimens, Camp 90, south of Jyekundo.

Wing measurements: males 61-65 mm.; females 60-63 mm.; unsexed 67.5-68 mm.

Evidently the birds from Camp 90 are larger than the specimens from Tatsienlu to Batang. Owing to the lack of material from the interior of Tibet the differences in wing length hardly warrant recognition by name. Later exploration might prove that there is still another race of this bird existing in the highest Tibetan country, distinguished by larger size than

the two known races, the range of which might extend from the sources of the Yalung river to the upper Yangtse (Jyekundo), Mekong and Salween. There seems to be the same tendency with *Phylloscopus armandii* as with many other birds: to produce a larger form in the highest Tibetan uplands, where very severe climatic conditions prevail throughout the year.

Also the specimens of the Stotzner-Weigold collection belong to the typical form, as well as the birds collected by Przewalski on the upper Yellow River and those brought by Berezovski and Beick from Kansu. I compared these birds with a very large series from Kansu (collected by Walter Beick, now in the Berlin Museum) and was not able to find any distinguishing marks in the colors. However, I presume that the southern limit between the two races of this wide-ranging *Phylloscopus* cannot be much farther south than the Tatsienlu-Litang-Batang road. (E. S.)

***Phylloscopus pulcher vegetus* (Bangs).**

Reguloides pulcher vegetus Bangs, Proc. Biol. Soc. Wash., XXVI, No. 24, p. 95, May 3, 1913. (Ya chia kun, Szechuan.)

Eight males, two females, one unsexed specimen, Tatsienlu, October 3, 1935; one female, Litang, September 24, 1934; all specimens in fresh winter plumage.

Wing measurements: males 55-60 mm.; females 57-59 mm.; together 55-60 mm.

This Willow Warbler is common throughout the Hsifan mountains and wooded parts of Chinese Tibet. According to my knowledge its breeding grounds occur at about 4000 meters, close to the upper tree limit. The bird is sensitive to sudden changes of weather and temperature and reacts correspondingly in descending from its lofty region as soon as cold weather comes along. In October I found hundreds of them in the narrow arid valleys around Tatsienlu, where they favor tall poplar trees. (E. S.)

***Phylloscopus proregulus forresti* Rothschild.**

Nov. Zool., XXVIII, p. 45, 1921. (Lichiang range, Yunnan.)

Four males: three, Batang, October 23, 27, 1934, measuring 53.5, 56.5 and 53 mm.; one, Dawo, October 3, 1935, measuring 56 mm.

All birds are in fresh winter plumage, bellies, and entire underparts washed with lemon color, upper parts olive-brown.

Forrest's Crowned Willow Warbler inhabits the coniferous parts and rather damp areas of the woodland region of the high mountains of Chinese Tibet. In winter it often joins parties of other birds such as titmice and and treecreepers. (E. S.)

***Phylloscopus trochiloides obscuratus* Stresemann.**

Ornith. Monatsber., p. 74, 1929. (Northern Kansu.)

Four males in fresh winter plumage: two, Dawo, September 1935; one, September 1935; one, Hokow, September 14, 1934. Two females: Tung-

gnolo, September 12, 1934; Seshu, Camp 137, August 8, 1935. One unsexed specimen, Camp 90, south of Jyekundo, May 25, 1935.

I refer all specimens to this race, as they are distinguishable from specimens which Weigold collected near Sungpan, by all the characters which Stresemann gives for *Ph. trochiloides obscuratus*. The two specimens from Camp 137 and from Camp 90 (south of Jyekundo) are even darker than Beick's specimens from northern Kansu (Berlin Museum).

Wing measurements: males 60-64 mm.; females 61-65 mm.; together 60-65 mm.

This bird is rather common in the wooded region of the Chinese Tibetan borderland. It penetrates into Tibet as far as the timber-belt but does not occur in the open Tibetan steppe country. (E. S.)

***Phylloscopus inornatus mandellii* (Brooks).**

Reguloides mandellii Brooks, Stray Feathers, p. 389, 1880. (Sikkim.)

Four males: two, Malashi, September 30, 1934; one, Dawo, September 27, 1935; one, Tatsienlu, October 3, 1935. Three females: one, Litang, October 15, 1934; one, Dawo, September 27, 1935; one, Tatsienlu, October 3, 1935. Seven unsexed specimens: two, Tatsienlu, September 9, 1934 and October 3, 1935; one, Dawo, September 27, 1935; four, Camp 90, south of Jyekundo, May, 1935.

These birds vary in wing length from 53.5 to 59 mm.

I found this bird fairly common among the coniferous woods of the southern parts of Khams. South of Jyekundo, however, it was quite rare. In October I found there specimens with many *Phylloscopus pulcher vegetus* in a stand of huge poplar trees at the bottom of the Tatsienlu valley at an altitude of 2700 meters. (E. S.)

***Phylloscopus weigoldi* Stres.**

Phylloscopus weigoldi Stresemann, Abh. u. Ber. Mus. f. Tierkunde Dresden, XVI, 2, p. 16, 1924. (Dschiesongea near Tatsienlu.)

One pair, upper Yalung, Camp 79, Drechu Gomba, in breeding plumage, June 10, 1935. Male 62.5 mm., female 57 mm. wing measurement.

Another pair, Camp 141, September 2, 1935; male 57.5 mm., female 57 mm. wing measurement.

It is hard to decide whether this bird should be interpreted as a distinct species or only as an ecological race of *Phylloscopus fuscatus* as it only occurs sporadically on the dampest and highest places above the timberline in the dwarf-brush region which forms the habitat of *Phylloscopus fuscatus robustus*.

The bird penetrates far into true high Tibetan steppe country and seems to replace *Phylloscopus fuscatus* in the northern and northwesternmost region of the Tibetan dwarf-brush region. (E. S.)

Phylloscopus occipitalis coronatus (Temm. and Schleg.)

Ficedula coronata Temminck and Schlegel, in: Seibold Fauna Japonica, Aves, p. 48, 1847. (Japan.)

One male, Hoangnipu, Hsifan mountains, August 10, 1934, wing 59 mm. Two females, Lengchi, Hsifan mountains, August 17, 1934, wing 60 mm.

This Willow Warbler seems to be entirely restricted to the subtropical valleys of the Hsifan mountains, where I secured the only specimens in tall trees along the mountainsides at an altitude of 1500 meters. However, later exploration in these areas might prove that *Phyll. occipitalis coronatus* also follows the gorges of the larger rivers farther into true Tibetan country, possibly as far as deciduous trees go. (E. S.)

Phylloscopus reguloides claudiae (La Touche).

Acanthopneuste trochiloides claudiae La Touche, Bull. B. O. Club, XLIII, p. 22, 1922. (Mengtz, Yunnan.)

Eight males: three, Magidrong, near Hokow, September 18, 1934; one, Hokow, September 13, 1934; one, Malashi, September 30, 1934; two, Tatsienlu, September 2, 1934; one, Dawo, September 25, 1935. One female, Dawo, September 25, 1935. One unsexed specimen, Wangmu, near Tatsienlu, August 22, 1934. These birds measure from 60-67 mm. wing length.

The bird favors the southeastern Tibetan woodland region where deciduous trees are common (birch, poplar, willow, walnut) among the dark coniferous forests. It likes the high tree tops along the streams and rarely ventures into the deep forest. (E. S.)

Phylloscopus magnirostris Blyth.

Journ. As. Soc. Bengal, XII, p. 966, 1843. (No given type locality; Calcutta.)

One male, Hoangnipu, Tung valley, August 10, 1934, measuring 69 mm. in the wing and a female, near Tatsienlu, September 9, 1934, measuring 68 mm.

This extremely shy bird lives along the thickly covered streams and rivers in the Hsifan mountains and in the lowest valleys of Chinese Tibet. Its range does not extend far into proper Tibetan country. The bird is seldom seen as it frequents the willow-thickets, but its loud voice is always heard if one travels along in the stream beds. (E. S.)

Phylloscopus trivirgatus ricketti (Slater).

Cryptolopha ricketti H. H. Slater, Ibis, p. 174, pl. 4, 1897. (Kuatun, Fokien.)

An unsexed bird with a wing of 50 mm. was taken near Huangnipu on August 15. It is moulting and in poor plumage. (R. M. S.)

Seicercus burkii valentini (Hart.)

Cryptolopha burkii valentini Hartert, Vög. Pal. Fauna, I, p. 497, 1907. (Tai-pai-shan.)

Two specimens with wings of 56 mm. and 57 mm., were secured at Hwalinpin in August. (R. M. S.)

***Abornis albugularis fulvifacies* Swinh.**

Abornis fulvifacies Swinhoe, Proc. Zool. Soc. London, p. 132, 1870. (Szechuan.)

Two immature males were secured at Yachow and Huangnipu in August, and one unsexed adult at Chengtu in July. (R. M. S.)

***Prinia inornata exte* Thayer and Bangs.**

Prinia inornata exte Thayer and Bangs, Mem. Mus. Comp. Zool. Harvard, XL, No. 4, p. 182, 1912. (West Szechuan).

An unsexed bird taken at Chungchow, August 1. (R. M. S.)

***Suya crinigera catharia* (Reich.)**

Prinia catharia Reichenow, Orn. Monatsber., XVI, p. 13, 1908. (Tatsienlung, Szechuan.)

Two males and one female were secured at Chungchow, Lutingchao, August 1 and 18. They are moulting. A male in fresh plumage was secured at Leh, December 16. The wings range from 45 mm. to 58 mm. (R. M. S.)

REGULIDAE***Regulus regulus himalayensis* Jerdon.**

Bds. India, II, p. 206, 1863. (ex Blyth, M. S., "N. W. Himalayas".)

One pair, Tunggnolo, Camp 6, September 9, 1934; two males and one female, Hsignolo, about 50 miles west of Hokow, Camp 12, September 20, 1934; three males and one female, Malashi country, south of Litang, Camp 18, October 2, 1934; one male, Batang, October 28, 1934; one unsexed specimen, Camp 46, February 1935.

Wing measurements: males 52.5-58.5 mm.; females 53-55 mm.; unsexed specimen 56 mm.; together 52.5-58.5 mm.

All specimens in fresh winter plumage.

Dr. Stone, who referred the specimens collected on the first Dolan Expedition of 1931, from the neighborhood of Sungpan, to *Regulus regulus yunnanensis* (Rippon), states that he could not see the differences between his specimens and true *himalayensis*. Having met with the same difficulty, I sent a series to Leningrad for comparison. I therefore refer all the specimens of the second Dolan Expedition to this form.

Common resident of the fir and spruce forests of Hsifan and Khams. Generally met in the company of other birds. (E. S.)

***Leptopoeile sophiae obscura* Przew.**

Leptopoeile obscura Przewalski, Zapiski Imper. Akad. Nauk St. Petersburg, LV, p. 80, 1887. (Northeast of Tibet).

Six males: three, Litang, October 5, 1934; one Tatsienlu, September 1935; these specimens are in winter, the following two males, in breeding plumage: Jyekundo, April 4, 1935.

Four females: three, Litang, October 5, 1934; one Tatsienlu, September 1935.

Measurements: males, wing 51-52.5 mm., beak 10.5-11 mm.; females, wing 50-52 mm., beak 11 mm.

This bird is very widely distributed over Chinese Tibet, ranging from the timberline upward, being one of the most typical species of the dwarf scrub zone. A very hardy bird which may be found even in midwinter, as high as 4600 meters. It is extremely gregarious, moving about in swarms like titmice and very often associating with *Parus superciliosa*, which also inhabits the highest brush region. (E. S.)

***Lophobasileus elegans meissneri*, Schäfer.**

Lophobasileus elegans meissneri Schäfer, Proc. Acad. Nat. Sci. Philadelphia, 89, p. 385, 1937. (Malashi, country south of Litang, Sikong.)

Five males: one, Hsignolo, September 20, 1934; four, Malashi, south of Litang, September 29, 1934. Two females, Malashi, September 29, 1934. One unsexed specimen, Hsignolo, September 22, 1934.

All these specimens are in fresh winter plumage.

Wing measurements: males 53-57 mm.; females 53-56 mm.

This new race represents a fine example of the already well-proved theory that Sikong (Khams) birds are as a rule, darker than specimens from Kansu.

These birds are not uncommon in the dark, palaeartic, coniferous forests of Sikong. Of gregarious habit, they like to associate with titmice and treecreepers in swarms. (E. S.)

MUSCICAPIDAE

***Alseonax latirostris latirostris* (Raffl.)**

Muscicapa latirostris Raffles, Trans. Lin. Soc. London, XIII, p. 312, 1822. (Sumatra.)

A small series including four juvenals in spotted plumage was secured at Tatsienlu in October. (R. M. S.)

***Hemichelidon ferruginea* Hodgs.**

Hemichelidon ferruginea Hodgson, Proc. Zool. Soc. London, XIII, p. 32, 1845. (Nepal.)

One female from Yachow taken in August. (R. M. S.)

***Siphia parva albicilla* (Pall.)**

Muscicapa albicilla Pallas, Zoogr. Rosso-Asiat., I, p. 462, 1811. (Dauria.)

A female was secured at Litang in September, and six additional specimens at Tatsienlu in October. (R. M. S.)

***Poliomyias hodgsonii* (Verr.)**

Siphia hodgsonii Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 34, 1870. (Moupin.)

Ten adult males: one, in winter plumage, Hsignolo, September 20, 1934, nine in fresh breeding plumage, Camp 90, south of Jyekundo, May 25, 1935; two immature males in gray plumage, same date and locality; two adult females in breeding plumage, same date and locality.

Wing measurements: males 72-75 mm.; immature males 68-69.5 mm.; females 71-71.5 mm.

One single specimen from Sikkim in the Berlin Museum has a much smaller bill.

This bird is distributed over wide areas of the Hsifan mountains and Khams, being fond of damp and heavy forests with much undergrowth; it ranges as far north as the wooded regions extend, parallel to the great river canyons. It lives in thick cover, being timid, and the best way of watching it is by sitting quietly in good shelter and waiting till the bird returns to its favorite spot. The male birds have a sweet song, brought forth from vantage points in tall trees. The immature males in their gray postjuvenile plumage sing just as well as the adult birds. Like all flycatchers, they are solitary birds, but sometimes they sing and breed close together in the thick growth of the river beds, so that one can hear several birds from the same place. (E. S.)

Zanthopygia zanthopygia (Hay).

Muscipapa zanthopygia Hay, Madras Journal, XIII, p. 162, 1845. (Malacca.)

Two males and a female from Yachow taken in August. (R. M. S.)

Eumyias thalassina thalassina (Swains.)

Muscipapa thalassina Swainson, Nat. Libr., XXI, Flycatchers, p. 252, 1838. (India.)

A male, a "female", (probably young male), and a juvenile bird from Huangnipu, secured in August. (R. M. S.)

Culicicapa ceylonensis ceylonensis (Swains.)

Platyrrhynchus ceylonensis Swainson, Zool. Illust., III, ser. 1, pl. 13, 1820. (Ceylon.)

Five of these flycatchers were collected from Yachow, Huangnipu, Sanchopin and Chungchow, during July and August. The wings measure between 57 and 64 mm. (R. M. S.)

Tchitrea incei (Gould).

Muscipeta incei Gould, Bds. Asia, II, pl. 19, 1852. (Shanghai.)

A female from Chengtu, taken in July. (R. M. S.)

MOTACILLIDAE

Anthus campestris godlewskii (Tacz.)

Agrodroma godlewskii Taczanowski, Bull. Soc. Zool. France, p. 128, 1876. (Argun river, South Dauria.)

Five males: three from Camp 72, Jyekundo, on the upper Yangtse, were taken May 19, 1935 (wing measurement: 91.5-96 mm.); two from Camp 139, on August 31, 1935 (measuring 91 mm. in the wing).

One unsexed specimen from Camp 139, August 31, 1935, with a wing measurement of 91 mm.

Fourteen females all of which were taken near Camp 139, August 31, 1935. These birds measure from 86 to 93 mm. in the wing.

I cannot decide whether this bird breeds in the lower Tibetan steppe country or not. The sexes seem to migrate in different flocks.

The bird was plentiful in late August and September, in the marshy valley bottoms of the gazelle steppe country. It is a very shy bird, easily recognized by its very harsh voice. (E. S.)

***Anthus hodgsoni hodgsoni* Richm.**

Anthus hodgsoni Richmond, Publ. Carnegie Inst. Washington, No. 54, p. 493, 1907. (China.) (New name for *Anthus maculatus* Jerdon.)

Eleven males: one, Cheto La pass, September 9, 1934; four, Malashi, south of Litang, one taken September 29, 1934, the three others September 30, 1934; five, Camp 142, September 2, 1935; one, Tatsienlu, October 3, 1935. These males measure 86-93.5 mm. in the wing.

Seven females: two, Malashi, September 29, 1934; one, Mili Ting (Batang), October 24, 1934; two, Camp 142, September 2, 1935; one, Dawo, September 25, 1935; one, Tatsienlu, October 3, 1935. These females measure 82-88 mm. in the wing.

These birds correspond to the original description; therefore I refer all my specimens to this form.

Common breeding bird in the subalpine palaeartic woodland region of Kham, Chinese Tibet. It lives at altitudes between 2700 and 4500 meters. (E. S.)

***Anthus roseatus* Blyth.**

Anthus roseatus "Hodgson" Blyth, Journ. As. Soc. Bengal, XVI, No. 5, p. 437, May 1847. (Nepal.)

Twelve adult males from Camp 77, upper Yangtse river, northeast of Jyekundo were collected April 16, 1935. These birds measure 88-91 mm. in the wing. Two adult females, same date and locality, measure 87 and 86.5 mm. in the wing.

The proportion in numbers of these males and females collected on the same day along a little brook (tributary of the Dreehu), indicates that the male birds probably migrate a little earlier than the females.

A pair of juvenal birds with rather abraded plumage, were taken on the Dashanling pass on August 12, 1934; the male measuring 89.5 mm. and the female 84.5 mm. wing length. The juvenal plumage does not show any well-pronounced markings; it is heavily mottled with greenish-gray and olive-brown, the chest not showing any reddish wash, which characterizes the full grown plumage of the adult bird.

This bird is common in the high alpine districts above the timberline, ranging nearly over our entire exploration field. Being fond of swamps, it lives in the Hsifan mountains as well as in the whole of Kham, and is common among the high alps around Jyekundo, but it does not occur in the denuded dry and cold mountains of the northern Kiang or wild yak steppes. It seems to need a certain amount of dwarf scrub cover and moisture for existence.

In the lower woodland region it is replaced by *Anthus hodgsoni hodgsoni*, and in the steppes, by *Anthus campestris godlewskii*. (E. S.)

***Anthus spinoletta blakistoni* Swinh.**

Anthus blakistoni Swinhoe, Proc. Zool. Soc. London, p. 90, 1863. (Banks of the Yangtse river 150 miles inland.)

Two adult males in breeding plumage from Jyekundo (Camp 72), upper Yangtse river, April 1 and 9, 1935; and one unsexed specimen, same locality.

The males measure 93-94 mm.; the unsexed bird 92 mm. in the wing.

These three birds (in breeding plumage) cannot be distinguished from birds collected by Beick in Kansu (Berlin Museum). However, the reddish-yellow wash on the chest might prove to be a little more intensive with high Tibetan birds in comparison with Kansu specimens.

Four females in winter plumage; all were taken in Batang, December 7, 1934, measuring 93-96 mm. in the wing.

In winter plumage these Tibetan birds seem to differ from Kansu specimens in being generally darker. The spots on the throat and chest are more plentiful and larger in Tibetan birds, which was further proved by comparison with one skin, collected by Weigold. Also the entire underparts seem to be more heavily washed with gray, the entire upperparts are more heavily striped, mixed with black markings, while Kansu specimens are more uniform in color with a brownish wash instead of gray.

Apparently the bird only migrates through Tibet, but does not breed there. On migration the sexes seem to be in different flocks. The birds are fond of swampy ground in the bottoms of the valleys at altitudes between 2500 and 3500 meters. (E. S.)

***Oreocory sylvanus* (Blyth).**

Heterura sylvana "Hodgson" Blyth, Journ. As. Soc. Bengal, XIV, p. 556, 1845. (Nepal.)

A female in worn plumage, was taken at Nitou, August 13. Its wing measures 78.5 mm. (R. M. S.)

***Motacilla flava beema* (Sykes).**

Motacilla beema Sykes, Proc. Zool. Soc. London, p. 90, 1832. (Dekkan, India.)

Two males: one, Tatsienlu, September 6, 1934, the other Camp 140, September 1, 1935.

Measurements: Tatsienlu, wing 75 mm., tarsus 22.5 mm., tail 65 mm.; Camp 140, wing 81 mm., tarsus 22 mm., tail 66 mm.

Six females: four, Tatsienlu, September 6, 1934; one, Tunggnolo, September 11, 1934; one, Camp 140, September 1, 1935. These females measure: wing 75-81 mm., tarsus 21.5-23 mm., tail 63.2-69 mm.

This race only migrates across the Chinese-Tibetan plateau-land. Mr. Whistler kindly informed me that it never breeds in Ladak, Kashmir, or Western Tibet. (E. S.)

Motacilla citreola citreola Pall.

Motacilla citreola Pallas, Reise Versch. Prov. Russ. Reiches, III, p. 696, 1776. (In Sibiria orientaliore frequens, rarior minorque in Russia.)

Three hybrid specimens: *Motacilla citreola citreola* Pallas x *Motacilla citreola calcarata*. Genuine *citreola*, three males: two from Tunggnolo, September 11, 1934; one from Jyekundo, May 15, 1935. These birds measure 91-93 mm. in the wing. One female, Jyekundo, May 15, 1935, measuring 90 mm. in the wing.

Hybrids. One male, Jyekundo, April 10, 1935; wing 88 mm.; this specimen is very dark on the upper parts, much like *calcarata*; the upper back between the shoulders being black, the lower back and rump with a very distinct grayish wash.

One male, Camp 76, April 15, 1935; wing 90 mm. This specimen is much lighter than the former one, according to wing length and color of the upper parts, more like *citreola*. However, it has a black band between the yellow of the head (upper neck) and the back. Upper back between wings, grayish black (like rump of former specimen) lower back and rump, lighter grayish black.

One male, Jyekundo, May 15, 1935; wing 84 mm. like *calcarata*. This third hybrid specimen resembles *citreola* very much, except that the band on the hind neck is grayish black, the upper parts otherwise gray, as in *citreola*.

These birds might come from breeding grounds hitherto unknown, where both races interbreed, probably the mountain chains of the middle Altai or from northwestern Mongolia.

Motacilla citreola citreola is a rare migratory bird on the Tibetan plateau, and does not breed there. (E. S.)

Motacilla citreola calcarata Hodgs.

Motacilla calcarata Hodgson, Asiatic Researches, XIX, p. 190, 1836. (Nepal.)

According to my large series of breeding birds from Sikong (Khams, Chinese Tibet) and the High plateau of Tibet, *Motacilla citreola weigoldi* (Rensch), which was supposed to have a longer bill, cannot be recognized as a distinct race. I consider *weigoldi* (Rensch) a synonym of *calcarata* (Hodgson).

Nine males: six, Jyekundo, May 15, 1935; three, Litang, September 24, and October 12, 1934. These males measure 83.5-88.5 mm. in the wing.

Five females: three, Jyekundo, May 15, 1935, and two, Litang, September 24, 1934 and October 7, 1934. These females measure 81.5-86.5 mm. in the wing.

The wings are a little longer in freshly moulted plumage. The autumn specimens, females and juvenal birds, are easily distinguished from *citreola* by having darker and duller upper parts.

This bird breeds in the high Tibetan plateau-land on swampy ground. (E. S.)

Motacilla cinerea caspica (S. G. Gmelin).

Parus caspicus S. G. Gmelin, Reise Russland, III, p. 104, pl. 20, fig. 2, 1774. (Enzeli, Caspian Sea.)

Two males: one, Tatsienlu, October 1, 1935; and one, west of Tatsienlu, taken September 9, 1934, measuring 78 and 79.5 mm. respectively.

Six unsexed specimens from Tatsienlu, all of which were taken October 1, 1935, measuring from 79 to 84 mm. in the wing.

Apparently this wagtail does not breed in Tibet, though I found one specimen May 11, 1931, near Chengwei in the Hsifan mountains.

In the spring and autumn the bird is quite common along small brooks and mountain streams in Hsifan and the Chinese Tibetan mountains. (E. S.)

Motacilla alba baicalensis Swinh.

Motacilla baicalensis Swinhoe, Proc. Zool. Soc. London, No. 23, p. 363, May 2, 1871. (Eastern Tibet.)

One female was taken near Jyekundo on the upper Yangtse, April 1, 1935, measuring 92 mm. in the wing.

This specimen on migration was picked out of a large flock of *Motacilla alba alboides*. It remained the only specimen of this race I have seen on the entire trip. Apparently this race touches the eastern Tibetan plateau country only on its eastern spurs, near the borders of the Hsifan mountains, on its seasonal migration. It is known however, to migrate through Tsaidam and the Ala Shan. (E. S.)

Motacilla alba leucopsis Gould.

Motacilla leucopsis Gould, Proc. Zool. Soc. London, p. 78, 1837. (India.)

Eight adult males: five, Yalung steppes near Kanze, Camp 142, September 2, 1935; two, Camp 143, September 2, 3, 1935; one, Camp 12, September 20, 1934. These males measure 92.5-95 mm. in the wing.

Two juvenal males: one, Camp 143, September 3, 1935, measuring 88 mm. in the wing; the other, Tatsienlu, September 7, 1934, measuring 85 mm. in the wing.

Seventeen females: one, Hokow, September 14, 1934; four, Camp 22, October 15, 1934; three, Yalung steppes near Kanze, Camp 142, August 31, 1935; two, Camp 142, September 2, 1935; seven, Camp 143, September 3, 1935. These females measure 83-92 mm. in the wing.

This race breeds only on the Tibetan steppe country while it is replaced by *Motacilla alba alboides* in the mountainous parts of Tibet, as well as in the Hsifan mountains. (E. S.)

Motacilla alba alboides Hodgs.

Motacilla alboides Hodgson, Asiatic Researches, XIX, Art. 12, p. 191, 1836. (Nepal.)

The birds which breed in the subtropical Red Basin of Szechuan, as well as in the subtropical, deeply-cut valleys of the Hsifan mountains (Gung, Ya, Min), show white chins in the breeding plumage. These birds

in their breeding plumages are otherwise identical with the high alpine and Tibetan winter birds, which have black chins and throats during the breeding season. These subtropical birds must be considered an ecological race of *Motacilla alba alboides*.

I. Summer Birds from the Subtropics with White Chins

Three males: one, thirty miles northeast of Yachow, August 3, 1934; one, Nitou in the Hsifan mountains, August 15, 1934; one, Waszekou, Tung river valley, August 20, 1934. These males measure 83.5-95 mm. in the wings.

Two females: one, thirty miles northeast of Yachow, August 3, 1934; the other one from Waszekou, Tung valley, August 20, 1934. The females measure 84 and 91 mm. respectively.

II. Summer Birds from Tibetan country with Black Chins. (High Alpine Birds)

Four males: three, Jyekundo, on the upper Yangtse, April 1, 1935; one from the same locality taken on April 6, 1935. These males measure 94-95 mm. in the wing.

Four females: three, Jyekundo, on the upper Yangtse, April 1, 1935; one, Camp 136, August 10, 1935. These females measure 91-94 mm. in the wing.

These summer birds with black chins, have much thicker plumage than the subtropical summer birds with white chins. The black on the chest also reaches farther down toward the belly in these high Tibetan specimens. It seems that the subtropical birds do not moult in early spring, but breed in winter plumage. In any case, the breeding plumage of the slightly smaller subtropical birds is not distinguishable in color from the winter plumage of the High Tibetan birds. The base of the throat feathers of High Tibetan birds is black in breeding plumage, while the winter specimens of Tibet and the summer specimens of the subtropics show a white base to the throat feathers. Because of finding adult subtropical birds with white chin feathers in August, I cannot agree with Weigold's supposition that the breeding birds of the subtropical lowlands moult between the first and second brood.

III. Winter Birds from High Tibet with White Chins

Six males: one, Litang, October 12, 1934; one, Camp 22, October 15, 1934; two, Batang, October 25, and December 6, 1934; one, Beyü, February 7, 1935; and one, Dawo, September 23, 1935. These specimens measure 91-97 mm. in the wing.

Two females: Dawo, September 29, 1935, measuring 89 and 91 mm. in the wing.

The white-chinned summer birds of the higher mountain valleys in the subtropical environment of the Hsifan mountains (Waszekou) reach the

wing measurements of the high Tibetan birds, but remain constant concerning the white chin feathers (like the birds of the Red Basin). Therefore, we are, strictly speaking, able to distinguish three ecological forms of *Motacilla alba alboides* in breeding plumage: Small size with white chin (from the subtropical Red Basin 600-700 meters); Large size with white chin (from the arid river valleys of the Hsifan mountains, 1000-1800 meters); Large size with black chin (from Tibetan territory west and north-west of Tatsienlu, Kham, and high Tibet, up to Jyekundo, 2500-5000 meters).

The juvenal birds of this race have ashy gray throats and chests and dull white bellies. The entire upper parts are gray with brown feather edgings. The postjuvenal moult takes place from the end of August till the middle of September in Tibetan territory.

Through the kindness of Col. R. Meinertzhagen, who owns a large series of breeding birds from Ladak, we found that this race differs much in the amount of white in the wing. There seems to be a slight tendency in the western Tibetan birds to show more white in the wing than there is in the birds of Szechuan and eastern Tibet.

Common breeding bird along the streams and rivers of our entire field of exploration, with the exception of the steppe country, where *Motacilla alba leucopsis* takes its place. (E. S.)

Dendronanthus indicus (Gm.)

Motacilla indica Gmelin, Syst. Nat., I, p. 962, 1788. (ex Sonnerat and Latham: India; Gould, Bds. Asia, pl. 67.)

One single unsexed but adult specimen was taken in the hills covered with pine forest, of the subtropical Red Basin of Szechuan, near Chungchow, on August 1, 1934, measuring 78 mm. in the wing.

The bird is in full moult, therefore it cannot be looked upon as a migrating specimen.

I found several adult birds with their young, furnishing evidence enough that the bird certainly breeds in the Szechuan Red Basin. The finding of this bird in subtropical environment—hitherto it was known to breed only in Ussuria, Sachalin, Korea and Chihli—supports Baker's puzzling statement, that this species breeds in Burma and Assam. (E. S.)

LANIIDAE

Lanius sphenocercus giganteus Przew.

Lanius giganteus Przewalski, Zapiski Imp. Akad. Nauk St. Petersburg, LV, p. 86, 1887. (Yellow River.)

Two males were taken near Camp 145 on September 4, 1935, measuring 138 mm. and 139 mm.

One female was collected in the high alps near Batang on December 7, 1934; it shows a wing measurement of 147 mm.

Two unsexed specimens came from the Tsong Ben La pass, near Batang, January 22, 1935, and from Camp 145, September 4, 1935, both measuring 134 mm. in the wing.

The Giant Shrike inhabits only Tibetan territory and does not occur in the Hsifan mountains. It lives in the high alps along the timberline and also breeds in the dwarf scrub region of the southern steppe country. The bird is very shy. (E. S.)

***Lanius cristatus lucionensis* L.**

Lanius lucionensis Linnaeus, Syst. Nat., ed. XII, p. 135, 1766. (In insula lucionensi.)

A pair in very worn plumage, in full moult, from Sanchopin, sub-tropical valley of the Hsifan mountains, taken August 15, 1934; the male showing 91 mm., the female 85 mm. wing measurement.

This bird belongs to the subtropical fauna of the Red Basin of Szechuan, penetrating the low parts of the Hsifan mountains through the great river trenches. (E. S.)

***Lanius schach schach* L.**

Linnaeus, Syst. Nat., ed. X, p. 94, 1758. (South China.)

Two males of this species were taken in the Szechuan Red Basin; one, Chengtu, July 30, 1934, measuring 103 mm.; the other, 45 miles northeast of Yachow, August 2, 1934, measuring 108 mm. in the wing. Both birds in worn summer plumage, badly moulting.

This bird takes the place of *Lanius tephronotus* in the subtropical lowlands of western China. It is quite common in the hilly districts of the Red Basin in the neighborhood of human habitation. It avoids dense forests and seems to work up on the lowest parts of the spurs of the high mountains of Hsifan. (E. S.)

***Lanius tephronotus* (Vig.)**

Collurio tephronotus Vigors, Proc. Zool. Soc. London, I, No. 4, p. 43, 1831. (April 6, 1831). (Himalayan Mountains.)

Five adult males: one, Tunggnolo, September 11, 1934; three, Camp 72, Jyekundo, upper Yangtse river, May 19, 1935; one, Camp 136, August 10, 1935. Wing measurements: 99-105.5 mm.

Two adult females: one, west of Tatsienlu, September 9, 1934; the other from Camp 136, August 9, 1935, measuring 101 mm. and 103 mm. in the wing, respectively.

One juvenal male from Camp 136, August 9, 1935, measuring 99 mm. in the wing.

The Gray-backed Shrike occurs in the Hsifan mountains and is a common bird throughout the Tibetan agricultural districts of Khams (Chinese Tibet), ranging northward as far as Jyekundo in the Yangtse river valley. In its southern habitat the bird is a resident, while it migrates in winter from the northern parts of its range to the southern valley. (E. S.)

STURNIDAE

Spodiopsar sericeus (Gm.)

Sturnus sericeus Gmelin, Syst. Nat., p. 805, 1788. (China.)

A pair from Yachow in August. (R. M. S.)

ZOSTEROPIDAE

Zosterops simplex simplex Swinh.

Zosterops simplex Swinhoe, Proc. Zool. Soc. London, p. 203, 1863. (China.)

A series of this White-eye was collected at Nitou, Chengtu and Yachow, during August. (R. M. S.)

PLOCEIDAE

Uroloncha striata squamicollis Sharpe.

Uroloncha squamicollis Sharpe, Cat. Birds Brit. Mus., XIII, p. 359, 1890. (Szechuan.)

A small number of this Paddy-bird was secured at Yachow and Chungchow, in August. (R. M. S.)

Passer montanus maximus Schäfer.

Passer montanus maximus Schäfer, Proc. Acad. Nat. Sci. Philadelphia, 89, p. 385, 1937. (Jyekundo, S. Kokonor.)

Eleven males: one, Nitou, Hsifan mountains, August 8, 1934; three, Litang, October 6, 1934; three, Batang, October 27, 1934; three, Jyekundo, April 2, 1935; one, Rongbatsa (Kanze), September 7, 1935.

Four females: three, Litang, September 24, 1934; one, same locality, October 6, 1934. One unsexed specimen from Rongbatsa, September 7, 1935.

Wing measurements: males 74-84 mm.; females 74-77.55 mm.

This Tibetan Tree Sparrow is larger than *P. m. kansuensis*. The under parts are duller in color and show more affinity to *obscuratus*. The beaks average a little longer than in *kansuensis*, but are more slender. Especially the upper mandibles are more pointed, the apex is very slender and slightly curved downwards. The differences in color between this race and *kansuensis* are extremely slight, even in large series, the main character being the extraordinary length of the wing. In fact we find with this bird, as is also true with many other species in our country of exploration, that the wing measurements constantly increase the higher and farther north we find the specimens. (E. S.)

Passer montanus obscuratus Jacobi.

Abh. u. Ber. Mus. Tier- u. Völkerk. Dresden, XVI, No. 1, Teil 2, April 15, 1923. (Hupeh and Szechuan.)

Two males: one, Chengtu, July 7, 1934, wing 64.5 mm.; one, Chungchow, in the Red Basin of Szechuan, July 31, 1934, wing 65 mm.

I have been able to compare a series of five birds from the Szechuan basin (Berlin and Dresden Museums) with a series of sixteen from Litang, Batang, and Jyekundo, with the result that I found them to be two well-

defined races. This race is distributed throughout the lowlands of Szechuan province, including the Red Basin, from which it enters some of the main river valleys (Min and Ya). In Sungpan, however, and westwards beyond the Hsifan mountain ranges, we encounter another much larger race of tree sparrow, which, owing to lack of material, previously had been considered *P. m. obscuratus*. (E. S.)

***Passer rutilans rutilans* (Temm.)**

Fringilla rutilans Temminck, Pl. Col., III, pl. 488, 1829. (Japan.)

One adult male from the neighborhood of Yachow, on the borderline between the Red Basin of Szechuan and the spurs of the Hsifan mountains. Subtropical habitats, tea gardens with large walnut trees, the hollows of which form shelter and breeding places for this bird. On August 8, 1934, a moulting bird showed the plumage very much faded, wing length 70.5 mm. This form is widely distributed along the western borders of the Red Basin, and enters only the large river valleys which are connected with it (Min valley to Maochow). It does not occur beyond the Hsifan mountain ranges, where the larger rivers form a direct connection with Yunnan. Even in the Tung valley we met with the other race, *Passer rutilans intensior* (Rothsch.). (E. S.)

***Passer rutilans intensior* (Rothschild).**

Bull. B. O. Club, XLIII, No. CCLXXI, p. 11, October 27, 1922. (Mekong Valley.)

One adult pair, two juvenal females, Nitou, Tung valley, Hsifan mountains, August 8, 1934.

Wing measurements: male 71 mm.; female 68 mm.; juvenal 60-66 mm.

This race inhabits the arid zones of the large, meridional river valleys of eastern Tibet and Yunnan, which are open to the south. Resident in the southern gorges (bend of the Yangtse river north of Lichiang), but semi-migratory further north. Near Hokow, on the Yalung, and probably also near Batang, on the Yangtse river, these birds disappear during the colder months of the year. They live and breed in holly trees. (E. S.)

FRINGILLIDAE

***Mycerobas carnipes* (Hodgs.)**

Coccothraustes carnipes Hodgson, Asiatic Researches, XIX, Art. 12, p. 151, 1836. (Nepal.)

Eight males: four from Camp 25, west of Litang, October 18, 1934; four from Camp 47 (Beyü), February 7, 1935. These males measure 117-129 mm. in the wing.

Six females: all of which were taken near Camp 47, February 7, 1935, measuring 116-123 mm. in the wing.

The females are generally smaller than the males. The great individual difference in size of the body, as well as of the bills, is very striking in this species. Also the differences in shape of the bills are very great, but not

entirely due to individual variation. The apex of the bill becomes worn with age and the horny covering seems to peel off and be renewed regularly.

This bird is a common resident of the juniper forests of physiogeographical Tibet, ranging from Tatsienlu in the southeast, up to Jyekundo, in the northwest, in our field of exploration. (E. S.)

***Chloris sinica sinica* (L.)**

Fringilla sinica Linnaeus, Syst. Nat., ed. XII, I, p. 321, 1766. (China.)

Three adult males: one, Chungchow, August 1, 1934; one, Yachow, August 8, 1934; one, Hoangnipu, August 11, 1934. These birds measure 77-80.5 mm. in the wing.

One juvenal male was taken in Yachow, August 8, 1934, measuring 79 mm. in the wing.

Two females, taken in Yachow on the same date measure 76 and 76.5 mm. in the wing.

The adult males are in very much abraded summer plumage.

In the females the yellowish green of the chest and belly is quite dark, bordered with a distinctly brownish wash. The plumage is loose and thin, the body feathers are already in moult. The upper parts of the males are dirty olive brown with a greenish gloss. The backs of the females are more uniformly brownish gray. The juvenal plumage is striped and mottled with gray on the upper, as well as on the under parts.

The base color of the under parts of the young male shows yellow: the throat is in post-juvenal moult, with a few bright yellow feathers.

This bird is restricted to the subtropical parts of the Red Basin of Szechuan (where it is fond of the hilly parts, living in pine forests), and also occurs in the deep, agricultural valleys of the Hsifan mountains, not entering Tibetan territory. (E. S.)

***Carduelis flavirostris miniakensis* (Jacobi).**

Acanthis flavirostris miniakensis Jacobi, Abh. u. Ber. Zool. Mus. Dresden, XVI, No. 1, p. 25, 1923. (Bameh and Dawo, near Tatsienlu and Kansego.)

Seven males: two were taken from the vicinity of Jyekundo, April 3 and June 19, 1935; four came from the large plain of Litang, taken October 8, 1934; one, west of Tatsienlu, September 10, 1934. These males measure 77.5-79.5 mm., with an average of 78 mm. in the wing.

Three females: one taken near Jyekundo, April 3, 1935; two in Litang, October 8, 1934. The females measure 76-78 mm. in the wing.

The morphological differences between this form and *Carduelis flavirostris leimonias*, the lighter race from Kansu (Beick coll., Berlin Museum), described by Meise, were easily detected with this series. I was unable to find any difference in size between the two forms. As there were no adult specimens taken in the northernmost part of its range on the upper Yangtse, near the bifurcation of the Chumar and Ulan Muren, the question

whether the birds are larger in the highest northern areas of Chinese Tibet, remains unsolved. However, I am inclined not to believe in a geographical dimorphism in size, as the bird lives in its southern range only in the highest and most desolate valleys and on the plateau country of the gazelle steppe, while in the northern parts of eastern Tibet, it inhabits only the deepest erosional valleys.

Three immature birds taken near Camp 117, July 1, have yellow bills; the under parts are uniformly mottled with grayish brown, the longitudinal stripes on the chest very faint. Also the upper parts of the juvenal plumage are more uniform in color with a very distinct brownish wash.

This bird does not occur in the Hsifan mountains; it belongs to the typical Tibetan resident fauna. It is a hardy bird, gathering in large flocks in autumn to winter in the Tibetan agricultural districts. (E. S.)

Uragus sibiricus lepidus David and Oust.

Uragus lepidus David and Oustalet, Ois. Chine, p. 359, pl. XCVIII, 1877. (La chaîne montagneuse du Tsing-ling, Shensi.)

One male specimen from the Yangtse valley near Derge, taken February 9, 1935, measuring 74 mm. in the wing. The bird is in fine winter plumage. The silky front of the head and throat and the rosy-red chest correspond to the description. The belly feathers are whitish, becoming grayer toward the tail and under tail feathers, therefore this specimen does not yet seem to show the fine plumage of an adult male, completely moulted.

A rare resident species, populating the deep valleys of the Hsifan mountain and the woodland zone of Chinese Tibet (Sikong). (E. S.)

Pyrula erithaca wilderi Riley.

Riley, Proc. Biol. Soc. Washington, 31, p. 33, 1918. (Chihli.)

Three males and three females from the upper Yangtse, collected near Beyü, February 7, 1935. All birds in fine winter plumage.

This bird is not very common, but widely distributed over the deciduous woodland region of Khams, Chinese Tibet. It does not occur in the dense coniferous forests. (E. S.)

Erythrina rubicilla severtzowi (Sharpe).

Carpodacus severtzowi Sharpe, Proc. Zool. Soc. London, p. 354, 1886. (Turkestan and Yarkand.)

Three adult males from the region of the upper Yangtse river valley, north of the timberline; one taken near Camp 73, April 13, 1935; one, Camp 117, June 29, 1935; one, Camp 128; July 17, 1935. These birds measure 115-118 mm. in the wing.

One immature male in gray plumage from the gorges of the upper Yangtse, near Jyekundo, Camp 76, June 8, 1935; measuring 112 mm. in the wing.

Three females from the same localities, along the Yangtse river; two, Camp 73, April 13, 1935; one, Camp 101, June 9, 1935.

My birds are distinctly darker than specimens from western Tibet (Meinertzhagen coll.) and from eastern Turkestan (kindly examined by Dr. Stegmann, Leningrad). I came to the conclusion that the darker colors of the red feathers, as well as of the melanins, are due to abrasion, as nearly all of my specimens are summer birds with much worn plumage. Dr. Stegmann, to whom I sent a few birds, suggested at first that they belonged to a new race, but later, after comparing more material, he said that the supposed darker form certainly could not be surrounded on all sides by one slightly differentiated form. I refer my specimens to *severtzowi*.

I met this bird only in a very small area along the banks of the Yangtse river, north of the timberline. *Erythrura rubicilla* replaces *Erythrura rubicilloides* in the cliffs of the valley bottoms, where it breeds. (E. S.)

***Erythrura rubicilloides rubicilloides* (Przew.)**

Carpodacus rubicilloides Przewalski, Mongol i Strana Tangut, 2, p. 90, pl. 12, 1876. (Kansu.) (Transl.: Rowley, Orn. Misc., II, p. 299, pl. 54, iv, 1877.)

Five adult males: three, Beyü (Camp 47), February 7, 1935; one, Camp 72, Jyekundo, May 19, 1935; one, Camp 137, August 11, 1935. These males measure 105-112 mm. in the wing. The bird is darker red in abraded summer, than in fresh winter plumage.

One immature male in gray plumage taken on the Tsong Ben La pass, east of Batang, on October 22, 1934, with a wing measurement of 104 mm.

Three females: two from Camp 47, Beyü, on February 7, 1935; one from the Tsong Ben La, on October 22, 1934. These birds measure 102-103 mm. in the wing.

This Rose Finch is quite rare in Chinese Tibet (Sikong), ranging over the high alps, mostly above the timberline. It does not occur in the Hsifan mountains. Near Jyekundo it occurs with *Erythrura rubicilla*, but lives and breeds higher than the latter. (E. S.)

***Erythrura thura feminina* (Rippon).**

Carpodacus thura femininus Rippon, Bull. B. O. Club, XIX, No. CXXIX, p. 31, Dec. 31, 1906. (Yangtse River, W. Yunnan.)

Five adult males, all of them taken in the neighborhood of Mili Ting, near Batang (Yangtse river), October 24, 1934. The wing length of these birds varies from 83 mm. to 88.5 mm. All are in fine winter plumage.

Four adult females: one, Malashi, south of Litang, September 29, 1934; one, Batang, November 11, 1934; one, Beyü, Camp 47, February 7, 1935; one taken near the Gur La pass on the Yangtse-Mekong divide, southwest of Jyekundo, on May 5, 1935. These females measure 83-87 mm. in the wing.

One immature male in gray juvenal plumage not showing any red: Mili Ting, near Batang, October 24, 1934, measuring 84 mm. in the wing.

These specimens seem to be a little smaller than birds from Kansu, belonging to *dubius*.

This bird is one of the most characteristic species of the palaearctic coniferous woods of Kham (Chinese Tibet). It ranges from Yunnan, following the great river trenches northward to the tree limit in the valleys of the upper Yangtse and Mekong. The bird has a very distinct call, resembling the bleating of a young goat or sheep. The bird is not shy and can be easily observed along the upper timberline of large fir or spruce forests. (E. S.)

***Erythrura pulcherrima argyrophrys* (Ber.)**

Carpodacus argyrophrys Berlioz, Bull. Mus. Paris, (2), I, No. 2, p. 131, Feb. 1929. (Northeast China.)

Four adult males: one was taken near Camp 76, upper Yangtse river near Jyekundo, April 15, 1935; two from Camp 137, upper Yangtse, August 11, 1935. These birds show much abrasion. One from Dawo, September 26, 1935; the latter has not yet completed the post-juvenal moult. These male birds measure 82.5-90 mm. in the wing, the great variation probably being due to the different stages of moult.

One immature male in post-juvenal moult showing the first adult feathers on the back and flanks, was taken in Hsignolo, September 20, 1934, measuring 88.5 mm. in the wing.

Four adult females: one taken near Camp 135, September 7, 1935; one, near Hsignolo, September 20, 1934; one, Camp 25, October 18, 1934; one, Camp 26, October 19, 1934. These females measure 80.5-85 mm. in the wing.

This species closely resembles *Erythrura eos* (Stresemann) but the difference in wing length is very constant throughout my series. I was unable to find any difference in color among the females of both species. The adult males of this species, however, have much lighter reddish feathers, and the whitish colors of the feathers around the anus are constant and correspond exactly to the distinction given by Stresemann in the original description of *eos*.

In Sikong, the bird is not quite as common as *Erythrura eos*; it seems to be restricted to lower altitudes in the Tibetan agricultural districts of Chinese Tibet. It is not as hardy as *Erythrura eos*. Although able to collect forty-five specimens of *Erythrura eos*, I collected only nine specimens of *E. p. argyrophrys*. (E. S.)

***Erythrura eos* Stresemann.**

Orn. Monatsber., XXXVIII, No. 3, p. 75, May 1930. (Sungpan.)

Thirty adult males of this species were taken; one, Wangmu, near Tatsienlu, August 22, 1934; one, Tunggnolo, September 11, 1934; two, Hokow, September 14, 1934; one, Camp 26, October 19, 1934; two, Leh, near Batang, Yangtse river-gorge, November 19, and December 30, 1934; eleven, Beyü (Camp 46), February 7, 1935; three, Kolondo, Camp 53, February 17,

1935; one, Buho, February 23, 1935; three, Camp 74, upper Yangtse, near Jyekundo, April 13, 14, 1935; five, Camp 76, upper Yangtse river, April 15, 1935 and one from the Gur La, Yangtse-Mekong divide, southwest of Jyekundo, May 1935. These males measure 68-79 mm. in the wing. The large difference in wing length seems to be due to seasonal variation. The average wing length is 77 mm.

Five immature males in gray plumage; two were taken in Tunggnolo, September 11, 1934; two in Leh, November 19, 1934; one in Kolondo, February 17, 1935. These birds measure 75.5-78.5 mm.

Nine females: one was taken near Wangmu, north of Tatsienlu, August 22, 1934; four from Leh, south of Batang, November 19, 1934; one from Beyü, February 7, 1935; one, Gur La, Yangtse-Mekong divide, southwest of Jyekundo, May 5, 1935; one, Camp 76, upper Yangtse, near Jyekundo, April 15, 1935; and one, Tatsienlu, October 1, 1935. These females measure 72-76 mm. in the wing.

The post-juvenal moult of the young males from the first brood occurs in September, the warmest month in High Tibetan territory. The young males from the second brood seem to remain gray for the first year.

This bird seems to live and breed higher than *Erythrina pulcherrima argyrophrys*, descending to lower altitudes only in winter, when they gather in large flocks in the Tibetan agricultural districts. (E. S.)

***Erythrina rhodopepla* (Vig.)**

Fringilla rhodopepla Vigors, Proc. Zool. Soc. London, p. 23, 1831. (Himalayas.)

I found only one female specimen of this very rare bird at an altitude of 3700 meters, near the Cheto pass, west of Tatsienlu. The bird was still moulting, being in very worn condition of plumage. The wing measures 70.5 mm.; the tail 62 mm.; and the tarsus 18 mm.

Père David collected only one gray specimen of this species in Mupin, Zappay brought three from the Washan at an altitude between 3600-4270 meters, and Wiegold took one also from the Washan. The birds seems to be a rare breeding bird in the Hsifan mountains, but certainly does not live in physiogeographical Tibetan territory. (E. S.)

***Erythrina vinacea vinacea* (Verr.)**

Carpodacus vinaceus Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 39, 1870. (Montagnes du Thibet chinois.)

A single specimen of this rare species was taken near Hwalinpin, in the Hsifan mountains, August 16, 1934. The very much abraded wing measures only 69 mm. The bird is in full moult, but agrees with the specimens in the Berlin Museum.

This Rose Finch does not penetrate palaearctic Tibetan country but seems to be restricted to the subtropical Hsifan mountains. (E. S.)

Erythrina trifasciata (Verr.)

Carpodacus trifasciatus Verreaux, Nouv. Arch. Mus. Paris, VI, Bull., p. 39, 1870. (Montagnes du Thibet chinois.)

One pair was taken in Mili Ting, near Batang October 24, 1934, the male measuring 86.5 mm., the female 86 mm. in the wing. The male is in juvenal, the female in fresh winter plumage.

This rare bird lives in the eastern and southeastern parts of Sikong (Khams), and probably also in the palaearctic regions of the Hsifan mountains at high altitudes. It is fond of coniferous woods, but does not penetrate far into Tibet. (E. S.)

Erythrina erythrina roseata (Hodgs.)

Pyrhulinnota roseata Hodgson, Proc. Zool. Soc. London, XIII, No. 146, p. 36, Aug. 1845. (Nepal.)

Five adult males apparently in red breeding plumage, a few showing moult and feather wear, one taken August 22, still has a few gray juvenal feathers on the throat. One taken in Wangmu, north of Tatsienlu, August 22, 1934; one, from Tatsienlu, September 6, 1934; five specimens from Camp 135, Yangtse river valley northeast of Jyekundo, August 8, 1935. Wing measurements, 84-87 mm.

Three immature males in gray juvenal plumage: one, Camp 135, August 8, 1935; one, Tatsienlu, October 1, 1935; one, the Tsong Ben La pass, east of Batang, October 22, 1934, measuring 83.5-85 mm. in the wing.

Two females taken in Tatsienlu, October 1, 1935, measuring 84-85 mm. in the wing.

A migratory bird in Tibetan territory, it does not occur in the Hsifan mountains, although quite common in the scrub zone of the highest agricultural valleys. (E. S.)

Pyrhospiza punicea szetschuana (Bainchi).

Bull. Acad. Sci. St. Pétersbourg, (6), I, p. 189, 1907. (Southwest Kansu and northern Szechuan.)

One male and two females from the Batang mountains taken November 17, 1934. The wing of the male measures 120 mm. and the bill 14 mm.; the females 113-117 mm. and 14-14.5 mm.

The yellowish color of the rump feathers in the females is very striking in this long-billed race. The male is dark brown on the upper parts.

Rare resident and a very hardy bird of the highest alpine districts above the timberline in the Hsifan mountains and southern Sikong (Chinese Tibet). It does not penetrate far into the interior of Tibet. (E. S.)

Loxia curvirostra himalayensis (Blyth).

Loxia himalayensis Blyth, Journ. As. Soc. Bengal, XIII, No. 156, p. 952, Dec. 1844. (Nepal.)

A single poorly skinned, much damaged female specimen was taken in the Malashi country, south of Litang October 3, 1934, measuring 87.5 mm.

in the wing. It has a few green feathers scattered among the plumage of the upper parts and is gray on the sides.

The Himalayan Crossbill occurs only in physiogeographical Tibetan country. It is a rare bird, wandering over wide stretches of country, appearing here and there sporadically. It lives on the spores of firs and spruces, and seems to be restricted to the coniferous, virgin woods of Sikong (Kham, Chinese Tibet). I found it in 1931 near Sungpan; 1934 in Malashiland, near Batang, and in 1935, near Derge. (E. S.)

Kozlowia roborowskii (Przew.)

Leucosticte roborowskii Przewalski, Ibis, p. 411, 1887. (Aschuen Nor Mountains, Tibet.)

Kozlowia bianchi Kozlow, Exped. Kozlowi, Aves, p. 21, pl. 1, 1907. (Type *Leucosticte roborowskii*.)

Out of a series of six birds, only two were sent to Germany. This pair was taken near Camp 117, in the high Tibetan steppe mountains (wild yak steppe), the male measuring 125 mm. in the wing and 12.5 mm. in the bill (from nostril to apex), while the female measures 120 mm. in the wing with a bill 12 mm. in length.

The white spots on the head and neck of the males become very small and scarce during the breeding season.

The female has a yellow beak. Its primaries are much more abraded than those of the male, though both birds were taken on the same day. *Kozlowia* is one of the most characteristic resident birds of the northernmost and highest mountains of the Tibetan wild yak steppe. It is very rare. (E. S.)

Montifringilla nivalis henrici (Oust.)

Eurhinospiza henrici Oustalet, Ann. Sci. Nat., Zool., (7), XII, p. 293, pl. IX, 1891. (Tibetan Plateau.)

Six adult males were taken near Camp 79, on the upper Yalung river, May 3, 1935. These birds measure from 120 to 124 mm. in the wing, the bills (from nostril to apex) measure 14 to 16 mm. in length.

Six adult females from the same locality, same date, measure 116-120 mm. in the wing, 14.5-15 mm. in the bills.

The females are a little smaller than the males. The plumage of the upper parts is the same in both sexes. The entire bill of the male is glossy black, while the female has a yellowish lower beak. The black throat of the male is only faintly indicated in the female, only the base of the throat feathers being black, the tips whitish. The sides of the neck, the brown markings on either side of the chest and the cheeks, are more colorful in the male.

Resident of the highest Tibetan steppe mountains north of the timberline. Does not inhabit the wooded zone of Sikong. It is a very hardy bird. (E. S.)

Montifringilla adamsi adamsi Adams.

Montifringilla adamsi Adams (ex Moore M.S.), Proc. Zool. Soc. London, p. 482, 1858. (Ladak.)

Ten adult males: five were taken in Litang, October 12, 15, 1934; one, Camp 63, near Seshu, upper Yalung steppes, March 14, 1935; two, Jyekundo (Camp 72), April 2, 1935; two, Camp 78, April 17, 1935. These males measure 108-115 mm. in the wing.

Four adult females, all of which were taken in Litang, October 12, 15, 1934, measuring 102-110 mm. in the wing.

The breeding plumage of this species seems to be a little lighter, especially on the upper head and back, than the freshly moulted winter plumage, which shows a yellowish wash on the under parts. Due to abrasion of the primaries, the breeding birds of April have a little shorter wings than autumn specimens.

Two nestlings have yellow legs and beaks. The upper parts of the juvenal birds are mottled with brown, the sides of the body are washed with a reddish color.

This mountain finch is widely distributed over the rocky valleys of the high Tibetan steppe country; it neither occurs in the Hsifan mountains nor in the Tibetan woodland zone of Sikong, being restricted to the open country. (E. S.)

Montifringilla ruficollis ruficollis Blanford.

Proc. As. Soc. Bengal, p. 227, 1871. (Kangra Lama Pass, 15,500 ft., north of Sikkim.) Gould, Bds. Asia, V, pl. 5.

Seven adult males taken at Seshu (Ju Gomba), Camp 61, February 25, 1935, measuring from 94 to 97 mm. in the wing. One male from Camp 117, June 29, 1935, also measuring 97 mm. in the wing.

Four adult females were taken at Seshu (Ju Gomba), Camp 61, February 25, 1935, measuring from 91 to 96 mm. in the wing.

Two juvenal birds in immature plumage were collected near Camp 117, June 29, 1935. Both are females and measure 81 and 84 mm. in the wing. The juvenal birds are distinguishable by having very soft and woolly feathers. The black stripe on the chin is not yet developed, the rusty-red markings on the neck and the flanks of the body are very faint. The stripes of the upper parts are generally darker, the color of the upper head is darker grayish brown, than with the mature birds which are lighter, with a distinctly reddish wash on the upper parts.

Like *Montifringilla taczanowskii* this bird lives on the high Tibetan treeless steppe country in biocoenosis with *Ochotona melanostoma*, but it ranges a little higher than *M. taczanowskii*. It does not occur in the wooded parts of Sikong. (E. S.)

Montifringilla blanfordi blanfordi (Hume).

Stray Feathers, p. 487, 1876. Collected by Mandelli, Cat. Birds, Brit. Mus., XII, pl. 4. (Tibet.)

Pyrigilauda barbata Przewalski. Ibis, p. 412, 1887.

Two adult males were taken near Camp 117, June 29, 1935, measuring 94 and 98 mm. in the wing.

Two females from Camp 124, taken July 5, 1935 measure 94 and 95 mm.

The plumage of these adult birds is much worn and abraded, especially the primaries, causing the great variation in wing length amongst the males.

Four unsexed juvenal birds from Camp 117, taken June 29, measure 86-88 mm. in the wing.

I sent a few specimens for comparison to Dr. Stegmann, who confirmed the fact that all my specimens belong to the typical form.

I found this bird only in the highest Tibetan steppes, on the uppermost Yangtse, in semi-deserts and rolling plains of the wild yak steppe. (E. S.)

Montifringilla taczanowskii (Przew.)

Montifringilla mandelli Hume, Stray Feathers, p. 488, 1876. ("Borders of Thibet, north of Native Sikkim".)

Onychospiza taczanowskii Przewalski, Mongol i Strana Tangut, 2, p. 81, pl. XI, 1876. Translat: Rowley's Orn. Misc., II, p. 290, 1877. (Tetunga and Kukunor, steppes in northern Tibet.)

Seven males: six taken near Camp 57, upper Yangtse, February 21, 1935; one, near Camp 79, on the upper Yalung, April 28, 1935. These birds measure 104-112 mm. in the wing.

Two females, both taken near Camp 79, on the upper Yalung, April 27, 28, 1935, measuring 107 and 108 mm. in the wing. A female taken in July in much abraded plumage, is a little darker than the birds in fresh winter and breeding plumage.

A very characteristic bird of the high Tibetan steppe country, where *Ochotona melanostoma* is plentiful. It lives in biocenosis with these small rodents, sleeping and breeding in their burrows. (E. S.)

Leucosticte nemoricola (Hodgs.)

Fringilauda nemoricola Hodgson, Asiatic Researches, XIX, p. 158, 1836. (Nepal.)

Six adult males were taken near Camp 79, on the upper Yalung, May 4 and 6, 1935, measuring 100-103.5 mm. in the wing.

Five adult females, four taken near Camp 79, May 6, 1935, with wing measurements from 95 to 102 mm.; and the other, near Batang, October 28, 1934, with a wing length of 99 mm.

Three juvenal birds, Tatsienlu, September 30, 1935: one male measuring 97 mm.; one female, 93 mm.; and one unsexed juvenal, 94 mm. wing length.

The outer feather margins of the upper parts are more washed with red in fresh than in worn plumage. With the young birds from Tatsienlu (most likely second brood), the bills are not yet fully grown; the entire plumage

is browner, which is best shown on the upper part of the head, the back, chest and on the sides of the neck.

Common resident of the high alps of the Hsifan mountains and Sikong, ranging as far north as Camp 79. This bird might also be found in the highest coniferous forests of the palaearctic region. (E. S.)

***Leucosticte brandti haematopygia* (Gould).**

Montifringilla haematopygia Gould, Proc. Zool. Soc. London, p. 114, 1851. (Tibet.)

Three males and two females from Drechu Gomba, on the upper Yalung river, Kiang steppe country, the males measuring 116-118 mm., the females 112-114 mm. in the wing.

This race is much lighter than *Leucosticte brandti walteri* of the Hsifan mountains and Sikong. It ranges over all the high steppe mountains of the interior of eastern Tibet, going as far north as the Kukushili and probably also the Borhan Bhota and Marco Polo ranges. Resident of the highest parts of the Kiang and wild yak steppe, living with *Koslowia roborowskii* in some localities. (E. S.)

***Leucosticte brandti walteri* (Hartert).**

Vög. Pal. Fauna, I, Heft 2, p. 138, June 1904. (Sungpan, Szechuan.)

Five adult males in fresh winter plumage, with rather light colors, the rump more buff than in breeding plumage. One specimen was taken on the Shari La pass (Gari La), east of Batang, January 24, 1935; all the others near the Bonya Plain (Camp 36), January 25, 1935. These males measure 117.5-121 mm. in the wing.

Four females in winter plumage show the same characteristics as the above mentioned males. Two from Gemoh, east of Batang, January 22, 1935; two from the Bonya Plain (Camp 35), January 25, 1935. These females measure 108.5-115 mm. in the wing.

This bird, which inhabits the high alps of the Hsifan mountains, is also quite common in Sikong (Khams), above the timberline, but is replaced by *Leucosticte brandti haematopygia* in the steppe mountains north of the timberline. (E. S.)

***Petronia petronia jyekundensis* Schäfer.**

Petronia petronia jyekundensis Schäfer, Proc. Acad. Nat. Sci. Philadelphia, 89, p. 386, 1937. (Jyekundo, S. Kokonor.)

Seven males: four, Jyekundo, April 3, 1935; two, Jyekundo, April 6, 1935; one, Camp 144, September 4, 1935; in this latter specimen, which I made the type of *jyekundensis*, the wing is extraordinarily long. These males measure from 99 to 108 mm. in the wing, with an average of 103 mm. wing length.

Three females: one, Jyekundo, April 3, 1935; two, Jyekundo, April 6, 1935, measuring 97-100 mm. in the wing.

Three unsexed specimens; two, Jyekundo, April 3, 1935; one, Jyekundo, April 6, 1935, measuring from 98 to 101 mm. in the wing.

The high Tibetan specimens are much larger than southern Sikong birds, but the two forms cannot be distinguished in color. Both are a little darker than the lighter birds from Kansu, which again show nearly the same wing length as the southern Sikong birds. Meise already saw the difference in color between Kansu and Sikong birds, but did not value it with recognition by name. The differences in color really are so slight that only large series show them well. The Tibetan birds have darker crowns and backs. (E. S.)

***Emberiza elegans elegantula* Swinh.**

Emberiza elegantula Swinhoe, Proc. Zool. Soc. London, No. 9, p. 134, March 10, 1870. (Near Kweichow, Hupeh.)

Three males taken in subtropical valleys of the spurs of the Hsifan mountains; one, Hoangnipu, August 10, 1934; one, Sanchopin, August 15, 1934; one, Hwalinpin, August 16, 1934. These males measure 72-78 mm. in the wing.

All specimens in badly worn moulting plumage. The feathers of the body are very thin, in full moult, the secondaries are partly new, the primaries not yet in moult.

This darkest race of the Elegant Bunting is fond of the hilly, thickly covered parts of the Red Basin and the subtropical agricultural valleys of the Hsifan mountains. During the breeding season the birds are solitary, but in winter they come together, forming small flocks of from ten to twenty birds. (E. S.)

***Emberiza cia omissa* Rothschild.**

Nov. Zool., XXVIII, p. 60, May 1921. (Si Taipai-shan, Tsin-ling Mountains.)

Seven adult males: one, Tatsienlu, September 6, 1934; one, Malashi, October 2, 1934; one, Tatsienlu, October 2, 1935; two, Batang, October 26, 1934; one, Batang, October 27, 1934; and one, Leh (near Batang), November 19, 1934. These males measure 77.5-81 mm. in the wing and 71-77.5 mm. in the tail.

Two females: one, Tatsienlu, October 2, 1935, measures 78 mm. wing and 73 mm. in the tail; the other, Batang, October 26, 1934, measures 77.5 mm. wing and 75 mm. in the tail.

One immature female, collected in Waszekou (Tung river valley), August 19, 1934, measures 74.5 mm. in the wing, and is in post-juvenal moult, showing adult plumage already on the flanks and upper parts.

This bird lives in the dryer and colder valleys of the Hsifan mountains and the meridional river-gorges of Sikong, Chinese Tibet. In the southern subtropical districts *Emb. cia yunnanensis* takes its place and *Emb. cia khamensis* in the high alpine districts, as well as in the northern gorge of the Yangtse river near Jyekundo. This bird is very plentiful in the southern

Tibetan agricultural zone, where it was easily found in the thorny thickets and scrub regions along the fields and in the dry and rocky valleys. (E. S.)

***Emberiza cia khamensis* Sush.**

Emberiza godlewskii khamensis Sushkin, Proc. Boston Soc. Nat. Hist., 38, No. 1, p. 26, 1925. (Dza-chu, upper Mekong.)

Ten males: two, Tsong Ben La pass near Batang, October 22, 1934; one, the high mountains near Batang, October 27, 1934; one, the high alps near Leh (south of Batang), November 19, 1934; six, the river gorges near Jyekundo (upper Yangtse), April 4, 1935.

Four females: one, the mountains near Beyü (upper Yangtse river), February 7, 1935; the three others from Jyekundo, April 4, 1935.

These birds measure: males 86-91.5 mm. in the wing; 78-86.5 mm. in the tail; females 85-90 mm. in the wing; 77-86.5 mm. in the tail.

Three unsexed juvenal specimens; two from Camp 135, August 8, 1935, measuring 82 and 83 mm. in the wing, still in gray mottled juvenal plumage; one from the high mountains near Tatsienlu, October 2, 1935, measuring 85 mm. in the wing. This latter specimen is in the first stages of the post-juvenal moult, showing a few adult feathers on the back and flanks.

This large and light colored, (not as light as *nanshanica*) race of Tibetan Meadow Bunting, inhabits the coldest, northernmost river gorges of Sikong and Chinghai, Tibet and follows the high mountains southward, overlapping the habitat of *Emberiza cia omissa*. The differences in color between *khamensis* and *omissa* are very slight on the under parts. The gray parts are hardly distinguishable, but the reddish colors are richer in *omissa* and much lighter in *khamensis*. However, the differences on the entire upper parts are much greater. Though the black stripes are the same in both races, the brown and reddish-brown colors are much lighter in *khamensis*. The best distinguishing marks are the lighter rump feathers in *khamensis* (while those in *omissa* are darker reddish), and also the width of the outer tail feathers, which in *khamensis* are wider and much lighter in color. Also the color of the upper head seems to be darker and more distinct in *omissa*. Even the living specimens of *khamensis* can be distinguished with some experience from specimens of *omissa*, by its longer tail and its light reddish rump, which at a distance is much more showy than that of the darker *omissa*. My specimens from Jyekundo are the lightest of all. It seems that the bird becomes darker as its range extends southward. The size, however, seems to remain constant, independent of its geographical and horizontal range, as the bird lives in the low valleys in the northern areas of its range, while it inhabits the high mountains on its southern outposts.

Generally speaking, *khamensis* and *omissa* are geographical races, the former living in the northern, the latter in the southern districts of eastern Tibet, but in the contact zone, where both races meet, they become ecological

rares; *omissa* living below, in the valleys, while *khamensis* inhabits the alpine heights. (E. S.)

***Emberiza cia yunnanensis* Sharpe.**

Emberiza yunnanensis Sharpe, Bull. B. O. Club, XIII, p. 12, 1902. (Western Yunnan.)

One male from the subtropical parts of the Hsifan mountains taken near Nitou, August 13, 1934, measuring 75.5 mm. in the wing.

One juvenal bird, unsexed, from Dashanling, Hsifan mountains, August 15, 1934, measuring 70.5 mm. in the wing. The darker colors of this race are already unmistakably shown in juvenal plumage, rendering the race identification of this specimen not very difficult.

This richly colored race of meadow bunting ranges over the warm valley districts of the mountains of western Yunnan and penetrates into the southern Hsifan mountains. Farther north, in physiogeographical Tibetan country, it becomes replaced by *Emberiza cia omissa*. In winter I also found it in the hilly parts of the low Szechuan Red Basin, but whether the bird breeds there or not, I do not know. (E. S.)

***Emberiza cioides castaneiceps* Moore.**

Emberiza castaneiceps Moore, Proc. Zool. Soc. London, p. 215, 1855. (China.)

Two males from the subtropical region of Szechuan. One was taken in Yachow, August 4, 1934; the other in Nitou (Hsifan mountain valley), August 13, 1934, measuring 77 and 78 mm. respectively.

Both birds are in moult and therefore, in very worn condition.

This bird belongs to the subtropical fauna and does not penetrate far into the Hsifan mountains, being restricted to the deep erosional valleys. (E. S.)

***Emberiza fucata fucata* Pallas.**

Reise Versch. Prov. Russ. Reichs, III, p. 698, 1776. ("Ad Ononem et Ingodam in ripis".)

One male and an unsexed specimen from the subtropical valleys of the Hsifan mountains, the male taken near Chingchihsien, August 12, 1934, measuring 70 mm. in the wing; the unsexed specimen was taken in Hoangnipu, on August 10, 1934, measuring 68 mm. Both birds are in full moult, rendering identification difficult.

Weigold calls this bird Grass Bunting, as he found it in the subtropical environment along the borders of the Red Basin on stony, grassy slopes. It breeds in the same habitat.

When we passed the subtropical parts of Szechuan and the Hsifan mountains, I met the bird only twice. It was found in dry, grassy country, in the neighborhood of native villages. The bird belongs to the subtropical Chinese fauna. (E. S.)

***Emberiza pusilla* Pall.**

Emberiza pusilla Pallas, Reise Versch. Prov. Russ. Reichs, III, p. 697, 1776. (*Torrensis alpinum* Dauricarum.)

One male, Malashi, south of Litang, Sikong (Khams), October 2, 1934, measuring 72 mm. in the wing.

This northern Asiatic bird, according to Weigold's and to my own observations in Yunnan, 1931-32, winters in great numbers in western China, especially in the Red Basin of Szechuan and in Yunnan. My finding the bird in Malashi, where I collected it at an altitude of 3900 meters, shows that the species also sporadically touches high Tibetan territory on its way south. (E. S.)

***Emberiza koslowi* Bianchi.**

Bull. B. O. Club, XIV, p. 8, 1904. (R. Re-tschu, upper Mekong.)

Six specimens of this very rare high Tibetan Bunting were taken in the vicinity of Jyckundo in tributary valleys of the upper Yangtse and upper Mekong rivers, in April and May, 1935.

Five specimens in the Academy of Natural Sciences of Philadelphia measure:

	<i>Female</i>	<i>Male</i>	<i>Male</i>	<i>Male</i>	<i>Male</i>
Wing	91 mm.	94 mm.	95 mm.	94 mm.	94 mm.
Bill	9	9	9	9	9
Tail	80	90	93	—	95
Tarsus	23	—	22	22	21

One adult male, taken near Camp 90 on May 16, 1935, was carefully examined in Berlin. Its measurements were rather small: wing 93 mm., beak 9 mm., tail 82 mm. and tarsus 21 mm.

Detailed description of a male: Bill: bluish black; superciliar stripe white; chin, lower parts of face extending to the eye, reddish brown; throat, white; upper head and upper neck, black; stripe around the neck and chest, dusky bluish-gray; rump, lighter bluish-gray. The white of the throat is bordered below toward the chest with a blackish ring of feathers. The colors of the under parts become lighter in caudal extension. The dusky bluish gray of the chest becomes gray on the belly and whitish gray around the anus. The under tail feathers are washed with brownish-red cinnamon color; tarsus, light; feet, darker; iris, brown; the two outer tail feathers, heavily mixed with white, all the others, without white. Back, shoulders, upper wing coverts and part of the outer bars of the secondaries, are a beautiful reddish-chestnut brown.

Detailed description of a female: General color, brown and gray; superciliar stripe, very faint, extending to the occiput; throat, gray, slightly washed with white; chest, grayish white with a yellowish wash; lower chest and belly, ash gray. Upper head and neck, brownish gray, slightly striped, central part of each feather, darker. Shoulders and wing coverts, chestnut color. Back, chestnut, striped with black. Rump, bluish gray. Under tail feathers, lighter cinnamon color than in the male bird.

A very rare and quite shy bird, which seems to be restricted to the dry tributary valleys of the upper Yangtse and Mekong, north of the timberline. (E. S.)

***Urocynchramus pylzowi* (Przewalski).**

Mongol i Strana Tangut, 2, p. 99, pl. XV, 1876. Translat: Rowley Orn. Misc., II, p. 309, pl. 7. (Tatung river, northern Mongolia.)

A large series of both sexes was taken near Batang, January 1935; on the Tsong Ben La, January 22, 1935; near Seshu Gomba, March 1935; around Jyekundo, April 1935 and on the upper Yalung in May 1935. Though my series of more than thirty specimens came from eastern Tibet, which, according to Tugarinow and Stegmann (Ornith. Monatsber., p. 117, 1929), is considered to form the terra typica for another race, *Urocynchramus pylzowi coloratus*, I am unable to find any marked differences between my specimens and four well-preserved skins from Kansu (Sing territory, south Tetung mountains and Kokonor, Beick coll. in the Berlin Museum).

I could not see the characters given by Tugarinow and Stegmann for *U. p. coloratus*. On the contrary, I found the ring around the neck even more pronounced in Kansu specimens. The other supposed characters for *coloratus*, such as "darker markings of the upper parts, darker ear coverts, and the more saturated rusty brown on the shoulders", are not confirmed by my specimens.

On the upper parts the plumage is uniform throughout the series. However, the males, which have more brown on the shoulders, seem to be slightly darker.

The rosy and pink-colored under parts of the males are subject to great individual variation. In freshly moulted winter plumage, they are palish pink with a silky, glossy shine, as each fresh feather is bordered with a broad white seam, which is elongated into many fine feather filaments.

These white margins of the feathers are very delicate, being worn off in the course of the winter, and therefore the breeding plumage is much darker and redder. The abrasion continues during the spring and early summer months, causing the male's plumage to be reddest and darkest in August, shortly before the moult of the body feathers. The upper plumage also becomes much darker before the moult sets in, as the light feather margins all become abraded.

The juvenal plumage, too, is generally darker on the upper parts than the plumage of the adult birds. The chest is mottled with gray; the belly, uniformly grayish-white; while they otherwise resemble adult females. (E. S.)

ZOOLOGICAL RESULTS OF THE SECOND DOLAN EXPEDITION TO
WESTERN CHINA AND EASTERN TIBET, 1934-1936.

PART III.—MAMMALS ¹

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Although the larger mammals of the Tibetan plateau are probably now fairly well known, at least as to species, much nevertheless remains to be done in working out the details of distribution and racial status of many of them, while of the smaller species very little systematic collecting has been done. Most of our knowledge is due to the sportsmen and travellers who have reached the borders of these highlands and brought back trophies or specimens of the smaller mammals that fell into their hands. The Russian explorer, Przewalski, was one of the first naturalists to penetrate this region from the north. The many mammals which he collected have been in part reported upon by Büchner in various papers. Przewalski was followed in later years by his countryman Koslov who traversed the eastern borders of Tibet, while other travellers have reached the outposts of the region, coming by way of western China. Nearly a century ago, the English naturalist, Hodgson, during a residence in Nepal, made known various Tibetan mammals which he secured through native aid from the southern borders, and in more recent years a few British expeditions have brought back specimens from the region of Lhasa. The western borders of the Tibetan steppes have been penetrated a few times by collectors, notably by the Yarkand expeditions, of which the second, under the Austrian naturalist, Stoliczka, obtained an excellent representation of mammals, which were reported upon by Blanford in 1879, and constituted our first considerable knowledge of the mammals of Chinese Turkestan.

The collections secured by Mr. Brooke Dolan, II and his assistant, Ernst Schäfer, were made and brought back under such extreme conditions of hardship and transportation, that it seems remarkable they should have come through at all. While the large game mammals naturally absorbed much of their effort, a number of smaller species were collected, some of which serve to extend recorded distribution while others represent species very little known. One of the important objectives, the discovery of the haunts of M'Neill's Deer and the securing of specimens, was brilliantly

¹ For the general itinerary of the expedition, a list of the localities visited and the position of the numerous camps, reference should be made to Part I of the reports on the results of the expedition, published in this volume of these Proceedings, pp. 159-184, pls. 12-20, and route map.

accomplished. This species, and the yak, chiru, Tibetan gazelle, white-lipped or Thorold's deer, steppe fox, blue bear, gray-tailed hare, and one or two species of hamster-mice appear to be rather characteristic of the Tibetan plateau at high altitudes. Others, as the argali, wolf, red fox and some of the mouse-hares and meadow mice have a wide range up to the borders of China. Field notes on the wild yak and the argali have already been published by Schäfer (1936, 1937) and a brief general account of the expedition and the larger game mammals, illustrated by a number of Mr. Dolan's photographs, has been given by Mr. Arthur deC. Sowerby (1936). A complete list of the species obtained by the expedition follows, with field notes concerning some of the larger mammals, contributed by Mr. Dolan.

SORICIDAE. Shrews

Sorex ?minutus tibetanus Kastschenko.

Sorex minutus tibetanus Kastschenko, Survey of Mammals of Western Siberia and Turkestan, Tomsk, p. 93, 1905 (in Russian). Tsaidam.

A skin without skull from Seshu Gomba, Khams, August 12, 1935, may represent this species. The small hind foot measures 9.6 mm. The color above is distinctly brownish, about seal brown, without darkening, and the lower side of the body has a faint wash of pinkish buff, slightly more extensive and pinker than in European specimens, which otherwise it closely resembles.

Nectogale elegans Milne-Edwards.

Nectogale elegans Milne-Edwards, Comptes Rendus Acad. Sci. Paris, vol. 70, p. 341, 1870. Mupin.

Of this remarkable water shrew, a single skin was secured north of Batang (Camp 30), at Derge Göncchen (98° 45' E., 31° 50' N.) (Camp 52), but the skull unfortunately was lost. Field measurements are: total length, 217 mm.; tail, 89; hind foot, 28. At the base of the tail two lateral flanges unite to form a mid-ventral keel, while two others form lateral keels slightly farther out. The Himalayan Water Shrew, *Nectogale sikkimensis* is longer-tailed and apparently lacks the buffy wash over the entire throat and chest of the typical *elegans*, a character well marked in the specimen from Derge Göncchen.

HIPPOSIDERIDAE. Horseshoe Bats

Hipposideros armiger armiger (Hodgson).

Rhinolophus armiger Hodgson, Journ. Asiatic Soc. Bengal, vol. 4, p. 699, 1835. Nepal.

Two of these large horseshoe bats were obtained at Yachow, Szechuan Province, China.

VESPERTILIONIDAE. Simple-nosed Bats

Pipistrellus abramus (Temminck).

Vespertilio abramus Temminck, Monogr. de Mammalogie, vol. 2, p. 232, pl. 58, figs. 1, 2, 1835-41. Nagasaki, Japan.

A single specimen from Yachow, west-central Szechuan, China, must nearly represent the westward limit of distribution for this species.

Eptesicus sodalis ognevi Bobrinski.

Eptesicus ognevi Bobrinski, Materials for the Fauna (of Russia), Moscow, no. 15, p. 12, 1918?. Seven Mts. region of Bucharia, Askabad.

This is a medium-sized *Eptesicus* recalling a small *Scrotine* in general appearance, but paler above, nearly pale ochraceous buff, throat grayish white, chest and belly white, the hairs everywhere with dark slaty-gray bases; membranes and ears blackish.

A single specimen from Sherug, or Sheru (Camp 70), Khams, August 27, agrees well with the original measurements and with Ognev's brief diagnosis in his Key to Russian Bats (Journ. Mammalogy, vol. 8, p. 153, 1927). As a species, *E. sodalis* is known from Switzerland, but is apparently rare or overlooked there. The pale desert race described by Bobrinski from Bucharia does not seem to have been recorded from other areas. Hence this extension of its known range into eastern Tibet is noteworthy, though paralleled by that of other mammals. The forearm of the specimen measures 46 mm., agreeing with Bobrinski's original measurement; the foot with claw, however, measures 9.5 mm., for which Bobrinski gives 8-10 mm., without mentioning if this includes the claw. Thus the identification seems fairly certain.

CANIDAE. Dogs, Wolves, Foxes

Canis lupus chanco Gray.

Canis chanco Gray, Proc. Zool. Soc. London, p. 94, 1863. "Chinese Tartary."

In a previous paper I revived Hodgson's *Lupus laniger*, 1847, of Tibet for the wolf of the Gobi Desert and the region adjacent but overlooked the fact that *laniger* cannot be used in the genus *Canis* on account of the use of the same name previously for the domestic dog of the Puget Sound Indians. Gray's name, *chanco*, however, seemed nearly equivalent. Pocock (1935) has shown that the wolf of eastern Asia is hardly to be differentiated from that of Europe, except by slightly smaller teeth, while color varies so greatly both individually and seasonally that little value can be placed on supposed characters of this nature.

Two adult male wolves were secured by the expedition on the Chumar (Camps 118-126), and agree in being pale, whitish, with much black-tipping to the hairs of the middle of the shoulders or back. A third smaller skin has the black tips longer and more abundant, imparting a blackish look to

the specimen. Skull measurements of the two males, Nos. 17497 and 17498, follow in this order: greatest length, 234, 236 mm.; basal length, 208, 206; palatal length, 116, 116; zygomatic width, 129, 128; mastoid width, 79, 72.5; width across upper carnassials, 77.8, 72.5; upper cheek teeth, canine to last molar, 105, 98.4; lower cheek teeth, canine to last molar, 114.5, 114; first lower molar, greatest length, 29.1, 25.8; length of nasals, 92, 89; length of contact between premaxillary and nasal, 37, 44.

According to Mr. Dolan, wolves "were most numerous on the steppe. Those seen were always solitary, although at night they must run together to judge from the sound of their howling. Their principal food is probably ochotonas, though they sometimes kill gazelles and wild-ass colts, and probably sheep."

Vulpes vulpes montana (Pearson). Hill Red Fox.

Canis vulpes montanus Pearson, Journ. Asiatic Soc. Bengal, vol. 1, p. 99, 1832. Himalayas.

All the Old World Red Foxes are of generally similar appearance, but Pocock in his recent review of the foxes of British India (Journ. Bombay Nat. Hist. Soc., vol. 39, p. 38, Dec. 1, 1936) distinguishes the animal of the Himalayas from Gilgit to Sikkim, Tibet, and Yunnan, as having on the average a smaller skull and teeth than the typical Scandinavian race. There is much variation in color. One from Camp 61, Seshu, western Szechuan, taken February 27, 1935, has the nape fulvous, the middle of the back tipped with bright bay, flanks hoary, tibiae chestnut varying to fulvous posteriorly, and with a grayish spot on the metatarsus. The tail is full, with a white tip, its gray hairs finely pointed with black, and with its middorsal area fulvous. On the belly the hairs are gray at the base, tipped with white. A second skin in moulting condition was taken at Camp 147, Yilung, Szechuan, in September.

Vulpes ferrilata Hodgson. Steppe Fox.

Vulpes ferrilatus Hodgson, Journ. Asiatic Soc. Bengal, vol. 11, p. 278, pl., 1832. Near Lhasa, Tibet.

The pretty little Steppe Fox is readily distinguished by its relatively short tail (less than half the length of head and body), short ears, colored much like the nape with a clear pale-fulvous patch behind each, and by the thick but rather short and dense pelage. The center of the back is fulvous, slightly silvered with whitish tips and mixed with a few scattered black hairs; flanks grizzled as well as the tail, except at its tip which is white, and the extreme base above which is reddish or fulvous like the center of the back. Several specimens were secured, at Yilung (Camp 147), and Draya, on the Tibetan plateau, as well as two others from Tatsienlu, which probably came from farther west. One skin (without exact locality), differs from the others in that the entire back is sandy buff instead of the usual

fulvous and the flanks have very little admixture of black hairs, while the throat has almost no trace of the black tips on each side that form two blackish lines in most skins. This is apparently an unusually pale individual.

These foxes, Mr. Dolan writes, are found "all over the steppe. Schäfer found them most numerous on a steppe near Kanze. They are very stupid and easy to kill."

Cuon javanicus fumosus Pocock.

Cuon javanicus fumosus Pocock, Proc. Zool. Soc. London, p. 49, Apl. 16, 1936. Western Szechuan.

In his recent review of the Wild Red Dogs, Pocock makes all of them races of *C. javanicus*, the oldest name, and in this is doubtless correct. Three skins from western Szechuan, collected by the expedition are apparently referable to his new race, *fumosus*, based on a winter skin from "western Szechuan". One is from Gemoh (Camp 28), and is deep fulvous, almost chestnut on the back and upper side of the tail, the latter very thick and bushy with black tips to the hairs above. The lining of the ears, the throat, chest, and inner side of the limbs are white, grading into pale fulvous on the lower throat and abdomen. The upper lips are narrowly bordered with white, but the vibrissae are, as Pocock describes, not pale but dark chestnut, like the face. A second skin is from Tienshingou, and a third, of a deeper rufous mixed with black, is from Sungpan.

URSIDAE. Bears

Euarctos thibetanus (G. Cuvier).

Ursus thibetanus G. Cuvier, Ossements Foss., vol. 4, p. 325, 1823. Tibet.

An old female of this bear was killed in September 1931, at Tschotsi (Drukagi: Brit. Survey of India map), western Szechuan, the skull of which seems small, with the sutures well closed and the teeth considerably worn. The last upper molar is affected by caries. The skull measures: greatest length, 249 mm.; basal length, 231; palatal length, 131; zygomatic width, 158; mastoid width, 131; width outside molars, 61.8; upper cheek teeth, canine to last molar, 97; lower cheek teeth, canine to last molar, 106; length of last upper molar, 25.

Ursus arctos pruinus Blyth. Blue Bear of Tibet. Plates 21 and 22.

Ursus pruinus Blyth, Journ. Asiatic Soc. Bengal, vol. 22, p. 589, 1853. Near Lhasa, Tibet.

Ursus lagomyiarius Severtzow, Cat. Zool. Coll. Przewalski, p. 9, 1887. Kansu.

The so-called Blue Bear is hardly blue, but rather silvery, more like a Barren-ground Grizzly, with a white collar that may or may not be complete. In habits and structure also, it resembles the Grizzly, having a long skull, with long nasals the length of which equals or usually definitely exceeds the width across the last premolars of the upper jaw. These bears live on the barren areas of the Tibetan plateau eastward to the borders of

Szechuan and Kansu, subsisting largely at certain times of the year on the young of mouse-hares, which they unearth much as Grizzly Bears in western North America dig up and devour ground squirrels. In his revision of the Old World Brown Bears, Pocock (1932) justly regards the Tibetan animal as a race of the European Brown Bear and describes five skins in the British Museum. There is considerable variation in the coloring dependent partly on age and season. The Dolan Expedition secured a fine small series of winter-killed specimens, old and young, of both sexes. Of these a male from Waterh (Camp 62), Szechuan (No. 17359) killed March 17, is a general yellowish white to whitish with a buffy muzzle, a white collar, and with dark fore and hind limbs. The area between the shoulders and on the rump becomes darker, brown slightly silvered. Another specimen (unsexed, No. 17557) has a similar coloring, with complete white collar but the back is darker, a mixture of blackish brown and white. A third (No. 17358) from Batang, has the white collar incomplete dorsally, the sides of the head pale, the entire dorsal side elsewhere dark blackish brown, silvered over the middle of the back. Below, except for the complete white collar around the throat, it is dark, the chest black, becoming brown on the abdomen. In an immature male, No. 17361, the collar is narrow but complete dorsally, its hairs white to their base; legs blackish, and the entire back mottled in appearance, the hairs with blackish bases and silvery tips; the belly is pure white in the middle.

Cranial measurements of two adult males and two adult females follow:

No.	15035	17360	17363	17364
Sex	male	male	female	female
Greatest length	335	345	304	297
Basal length	306	306	270	270
Palatal length	179	180	156	158
Length of nasals	98	96	76	86
Zygomatic width	186	184	180	168
Mastoid width	142	142	138	127
Width across molars	88	92	81	84
Upper cheek teeth	129	134	113	117
Lower cheek teeth	147	152	133	132
Length of last upper molar	38.4	37	32	36

There can be no doubt that these bears, as Miller suggests, are closely related to the North American Grizzly Bears, which doubtless represent the Brown Bears in the New World.

The following notes on the distribution and habits of this large bear are contributed by Mr. Dolan: "These bears are distributed all over the marches of eastern Tibet, from the neighborhood of Tachienlu westward and northward into Tibet proper. They probably do not occur farther east than

Sungpan. Although they are present in some numbers on the forested slopes of the trenches of the large river courses, they are most abundant on the high steppes of northern Tibet and Kokonor, where they seem to live almost exclusively on ochotonas. The steppes are everywhere pitted with the excavations made by the bears in digging out these animals, which occur in incredible numbers and support thousands of foxes, wolves, bears, and various birds of prey. The Tibetan grizzly seems to have definite hibernating habits, although in the forested country around Batang we had good evidence that they frequently emerge in midwinter for water or for some other cause. Around Batang their favorite habitat seems to be the zone of prickly oak (*Quercus ilex*) between 10,000 and 12,000 feet, where food is abundant. On the high steppe they hibernate in shallow troughs in the grassland and do not seem to emerge before late March or April. On the steppes of the upper Yellow River in late April, I saw only a few, whereas Schäfer in July saw as many as fourteen in a single day in the same type of country. They are not persecuted by the natives, who are afraid of them and many of whom have a superstition that the bear is first cousin to man."

MUSTELIDAE. Weasels, Martens

Mustela altaica tsaidamensis (Hilzheimer).

Arctogale tsaidamensis Hilzheimer, Zool. Anzeiger, vol. 35, p. 309, Jan. 4, 1910.
Tsaidam Mts., Tibet.

Four males from Yalung Plain (Camp 79 and vicinity), Tibet, in April, are still in the winter pelage, and are decidedly yellower or more suffused with buffy above than are winter skins from the Altai and northwestern Kansu, taken as representing true *altaica*. Five other skins from the same region in summer coat (Camps 73, 101, 79) are more golden brown, less chocolate above than summer skins of *altaica*, and paler below. Two are entirely whitish on the under surface while the others show the usual white chin and throat, with the rest of the belly tinted buffy, not so deep and pinkish as in some specimens from northwestern Kansu. The fore feet from toes to the wrist, as well as more or less of the toes of the hind feet are white.

These specimens evidently represent Hilzheimer's *Arctogale tsaidamensis*, the type locality of which is the Tsaidam Mountains, Tibet. It was very briefly diagnosed as like *Putorius kathiah* Hodgson, but smaller, and with paler feet. Apparently, too, the *Mustela sacana* Thomas (Ann. Mag. Nat. Hist., ser. 8, vol. 13, p. 566, June 1914) from 150 miles southwest of Djarkent, and *Mustela kathiah caporiaccoi* de Beaux (Atti Soc. Ligustica Sci. e Lett. Genova, vol. 14, p. 65, 1935) are not very different. Hilzheimer's name antedates both, and his type came from the same general region, hence I use it for this race of southeastern Tibet.

In the series of skulls, it is apparent that with age the zygomata become more outwardly bowed, the sagittal and supraorbital ridges become slightly heavier in the male, the muzzle wider, and the postorbital constriction narrower. The following measurements help to supply a previous lack:

Cranial Measurements of *Mustela altaica tsaidamensis*

No.	17717	17733	17738	17734	17736
Sex	female	male	male	male	male
Occiput to front of incisors	41.3	47.4	48.0	47.0	—
Palatal length	17.2	21.1	22.1	20.5	22.5
Zygomatic width	—	24.5	—	24.3	27.7
Width of brain case	17.4	20.2	20.5	20.3	—
Interorbital distance	8.4	9.9	9.4	9.3	10.7
Width outside upper tooth rows	—	15.3	15.7	14.9	16.4
Upper cheek teeth	12.0	13.8	14.3	13.8	15.3
Lower cheek teeth	13.7	16.5	16.7	16.6	17.3
Postorbital constriction	8.8	10.3	7.5	7.9	7.4
Width of muzzle outside canine roots	9.5	10.0	10.5	10.2	12.7

***Mustela sibirica moupinensis* Milne-Edwards.**

Putorius moupinensis Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mamm., p. 347, pl. 59, 1868-74. Mountains of Mupin, Szechwan, China.

One specimen of this race of the Chinese highlands was taken at Batang (Camp 30), December 16, a female, in bright fulvous pelage, with the dark tail-tip characteristic of the subspecies. This is perhaps near the western boundary of the range.

***Mustela putorius larvata* (Hodgson). Tibetan Polecat.**

Putorius larvatus Hodgson, Journ. Asiatic Soc. Bengal, vol. 18, pt. 1, p. 447, pls. 11, 12, 1849. Utsang, southern Tibet.

Putorius tibetanus Hodgson, Journ. Asiatic Soc. Bengal, vol. 18, pt. 1, p. 448, 1849. Utsang, southern Tibet.

A single specimen of the Tibetan Polecat taken at Waterh (Camp 62), one day's march northwest of Seshu, without doubt represents Hodgson's "Black-faced Polecat of Tibet". It is, however, much paler than his description implies, with the fur of the body nearly white basally, without any fulvous tint, and tipped extensively with black. The facial mask extends only from the nose to the back corner of each eye, and the base of the short ears is also black. The skull of the specimen, a male, does not show the contact of the hamular process with the anterior point of the audital bulla mentioned by Pocock (1936) in his recent review of the polecats, so that this too, may be a character individually variable.

The skull of the specimen measures: length from occiput to front of incisors, 61.8 mm.; palatal length, 33; zygomatic width, 38.5; mastoid width, 34.1; width outside upper tooth rows, 23.2; upper cheek teeth, 20.8; lower cheek teeth, 25.2; interorbital width, 17.8; postorbital constriction, 13.4.

Pocock shows that *M.p. tibetanus*, coming from the same locality as *M.p. larvata*, is synonymous with it. He also regards the polecats as generically distinct from *Mustela*, of which they are usually regarded as a subgenus only.

Martes foina toufaea Hodgson.

Martes toufaea Hodgson, Journ. Asiatic Soc. Bengal, vol. 11, p. 281, 1842. Tibet.

A skin, lacking hind feet and skull, hence doubtless of native origin, agrees closely with the description of this Stone Marten. The entire upper part of the body is pale brown, the under fur drab gray with a faintly brownish or pinkish tinge; the tail darker, becoming black near the tip; fore feet and forearms dark brown. The ears are bordered with short white hairs; the chin, throat, and upper chest are pure white except for an irregular large brown spot behind the angle of the mouth on each side and two others in the central line of the throat. The specimen is labelled from Kolondo (Camp 53), Szechuan, but may have come from eastern Tibet whence it was originally described from imperfect specimens by Hodgson. Kolondo is in the Khams region of eastern Tibet.

FELIDAE. Cats, Lynx

Lynx lynx isabellina Blyth.

Lynx isabellina Blyth, Journ. Asiatic Soc. Bengal, vol. 16, p. 1178, 1847. Tibet.

A fine adult male was secured at Batang (Camp 30), January 2. In color it is dull ochraceous above, the hairs tipped with whitish, and with slight mixture of black hairs.

Mr. Dolan writes: "We saw but one, high up in an old glacial basin at 14,000 feet, catching ochotonas. It spied me at a great distance, and evidently mistaking me for a sheep or a musk deer, stalked to within two hundred yards."

OCHOTONIDAE. Mouse-hares

Ochotona tibetana tibetana (Milne-Edwards).

Lagomys tibetanus Milne-Edwards, Nouv. Arch. Mus. d'Hist. Nat., Paris, vol. 7, Bull., p. 93, 1871. Mupin, Szechwan.

This little brown mouse-hare is an inhabitant of thickets and scrub, often at high altitudes. It is apparently active throughout the year, for specimens were secured by the expedition in November, December, and February as well as in the summer months. The long, loose pelage of winter is decidedly paler than the shorter coat of summer, but in both the hairs have a long slaty base, then a pale subterminal ring,—pale buffy in winter, brighter ochraceous in summer,—and a black tip. Below, the hair tips are white, washed with pale buff on the throat and on the median area of the chest. Individual variation is not great and is limited to slight

differences in the intensity of the pale band, from buff to ochraceous. In summer specimens this often presents a decided brown tone. The winter coat is carried through the greater part of the year. In the specimens secured by the expedition it is represented from November 18 (Leh) to April 20 (Camp 79 in Kokonor, Tibet); while the summer coat is worn by those taken up to October 2. This species was collected at various localities between Hokow and Batang, and again "in bush", at one hundred miles northeast of Jyekundo, which must be near the limit of its westward range.

Ochotona dauurica melanostoma (Büchner).

Lagomys melanostomus Büchner, Zool. Przewalski Exped., Mamm., pt. 4, p. 176, Sep. 25, 1890 (description); pt. 5, pl. 22, figs. 2-3, Apl. 1, 1894. Kuku-nor, Tsaidam, Kansu.

A large series of mouse-hares, mainly taken in mid-April at Camp 79, one hundred miles northeast of Jyekundo, and in late February at Nojelina, represents this form which was described by Büchner on the basis of specimens brought back by Przewalski's expedition from farther to the northeast, Kuku-nor, Tsaidam, and Kansu. He points out that it is very similar to *O. dauurica*, but differs notably in that the tip of the nose and the lips are black instead of whitish, while the skull is stouter and larger, and somewhat more flattened posteriorly. There can be no question that in these eastern parts of Tibet this black-lipped form replaces the paler *O. dauurica* of the Mongolian desert and should be regarded as a subspecies of that animal. The fine series brought back by the Dolan Expedition further indicates that in winter pelage, *melanostoma* is less pale than typical *dauurica*, with a distinctly pinkish-buffy tint instead of pale buffy on the upper side; the central buffy streak on the chest is continued farther back, to the abdomen, or in some specimens the entire lower surface is suffused with pinkish buff. The blackish lips and tip of the nose are characteristic of the entire series. In summer skins the general tone is darker, more brownish, due to the effect of the many black tips and ochraceous-buff subterminal bands of the hairs. The backs of the ears are clearer blackish with less mixture of buff than in winter. The skulls of this series do not bear out Büchner's statement as to their larger size. They are, however, noticeably more proodont, with the upper incisors slanting forward at an angle, rather than being nearly perpendicular as they are in specimens from the Gobi.

Half-grown young were collected in mid-June at Camps 105, 107, on the Tibetan plateau. The long black claws of both fore and hind feet are a noticeable character of this species, and enable it to burrow in the open grasslands. The completely hairy soles further distinguish it from *O. pallasii* which it somewhat resembles exteriorly.

Ochotona erythrotis gloveri Thomas.

Ochotona gloveri Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 190, Feb. 1922.
Nagchukar, western Szechwan.

The fine series of some thirty-five Red-eared Mouse-hares falls readily into two groups, the first of which consists of ten specimens in winter pelage, taken at Leh, a day's journey south of Batang (Camp 30), in extreme western Szechuan. These are noticeably darker, more brownish on the back and with grayer cheeks contrasting with the buffy drab of the forehead, than in the series from farther west on the Tibetan plateau. They undoubtedly represent the winter coat of the race *gloveri* Thomas, of which previously only summer skins have been available for comparison. These latter include topotypes from Nagchukar and a skin from Mounin (N. of Tachienlu), the last collected in 1931 by Mr. Dolan. All these differ from typical *erythrotis* in their darker color and the less extent of the rufous in the summer pelage. This is shown in Büchner's figures and description of the original specimens. In his figure of a specimen in partially assumed summer coat, from Kansu, the rufous extends from the tip of the muzzle to and including the ears as well as the cheeks and sides of the head. A specimen from Chone, Kansu, in the Museum of Comparative Zoölogy, taken July 20, is similar, with a rufous throat and general russet tone over the back. The more southern race, *gloveri*, of extreme western Szechuan, on the other hand, is a much darker and browner animal, and in summer coat differs notably in having the bright rufous tint confined to the nose, forehead and ears while the sides of the face from before and above the eyes to the base of the ear are contrastingly gray, produced by the wide whitish subterminal band and blackish tip of the hairs of this region. In winter pelage the color is considerably lighter but essentially similar with well-marked contrast.

Büchner designated no type or type locality for his *Lagomys erythrotis*, but his figured specimen from Kansu, with the red summer coat coming in on the head and neck may be taken as the lectotype and northwestern Kansu as the general type locality.

The series of nine specimens from Leh and one from Drupalong were taken in late November. Farther west this race responds to the more arid conditions in its paler hues, and forms a well-marked race, which may be named, in honor of the organizer and leader of the expedition, as follows:

Ochotona erythrotis brookei G. M. Allen.

Ochotona erythrotis brookei G. M. Allen, Proc. Acad. Nat. Sci. Phila., vol. 89, p. 341, Oct. 25, 1937. Jyekundo, Khams, Tibet.

The material of this well-marked race has been discussed at length in the original description.

LEPORIDAE. Hares and Rabbits

Lepus oiostolus sechuenensis De Winton.

Lepus sechuenensis De Winton, Proc. Zool. Soc. London, for 1899, p. 576, pl. 32 (colored), Oct. 1. Dunpi, northwestern Szechwan.

Lepus sechuensis Trouessart, Cat. Mamm. Viv. Foss., pt. 2, p. 543, 1904.

Lepus setchuensis Hilzheimer, Zool. Anzeiger, vol. 35, p. 310, Jan. 4, 1910.

Lepus kozlovi Satunin, Annuaire Mus. Zool. Acad. des Sci., St.-Petersbourg, for 1906, vol. 11, p. 162, 1907. Re-tschu and neighboring valleys, Khams.

A series of seventeen skins of hares from localities west of Tachienlu falls readily into two series: one, consisting of specimens from Molashi, Litang (Camps 16-20), and west to Batang (Camp 30), which are noticeably darker; and the other, consisting of much paler examples, from the more open plateau to the westward, in Khams, from Jyekundo (Camp 72) and camps beyond. All belong to the gray-rumped group, with pale-backed ears and the tail white below with gray bases to the hairs. The base of the fur in the middle of the back is white or nearly so.

Without material sufficient to revise this group of hares, it is impossible at present to determine which of the various names applied to these are really valid. Apparently the oldest name given in the group is *Lepus oiostolus* of Hodgson, whose type came from Ladak, far to the west. The specimen on which this name is based, however, is too young to show clearly what the characters are (Blanford, 1879, p. 63). The next to be described is *Lepus sechuenensis* De Winton (1899) the type of which was from Dunpi, northwestern Szechuan. To this probably, the Litang-Batang series should provisionally be referred as a subspecies. With this race, further, it seems likely that *Lepus kozlovi* Satunin, 1907, is synonymous. In describing this hare, Satunin especially calls attention to its dark coloration,—with the entire upper surface so thickly interspersed with black hairs that some specimens look nearly all black. Satunin's specimens were from Re-tschu, Bar-tschu, Nam-tschu and Dse-tschu,—streams indicated on maps of northeastern Khams, near the Szechuan border. The series brought back by the Dolan Expedition are in winter pelage, and agree well with this characterization. Their rump patch is very dark iron gray, the individual hairs dusky at base, broadly tipped with whitish, and ending in a minute black point. The nape is clear buffy to ochraceous, like the back. The tail is blackish above, soiled white at the sides and below, where the hairs are blue-gray basally. Along the sides of the body are numerous long, projecting hairs, with their basal two-thirds blackish, their tips broadly whitish.

The specimens from farther west where higher and drier conditions obtain, are referred to the following race.

Lepus oiostolus przewalskii Satunin.

Lepus przewalskii Satunin, Annuaire Mus. Zool. Acad. des Sci., St.-Petersbourg, for 1906, vol. 11, p. 156, 1907. Gass, southern Tsaidam.

Lepus oiostolus tsaidamensis Hilzheimer, Zool. Anzeiger, vol. 35, p. 310, Jan 4, 1910. Wahon Mountains, Tsaidam.

The specimens collected by Schäfer from Jyekundo (Camp 72) and points to the northward on the Tibetan plateau are much paler, more buffy, with less admixture of black above than the Litang-Batang series. The rump patch is noticeably more whitish, the tail clearer white below, with only the extreme bases of its white hairs grayish. These paler hares, if not typical *oiostolus*, represent a closely allied race to which Satunin has given the name *prezawalskii*. They agree exactly with a specimen received from the Zoological Museum at Leningrad, collected by Kozlov in northwestern Kokonor, and identified as *L. oiostolus*. Probably Hilzheimer's *Lepus oiostolus tsaidamensis* is a synonym. It was very briefly described on the basis of a skin from Wahon Mountains, Tsaidam. Further, the status of Hodgson's *Lepus pallipes* is still uncertain. The types were from Lhasa and Sikkim. De Winton (1899) regards this as a synonym of *L. oiostolus*, although Blanford (1879) wrote that the type specimens appear "at first very distinct" from western specimens, taken near Yarkand. Should it eventually turn out that they are different, however, it may be that *pallipes* should replace *prezawalskii* for these specimens from northern Khams.

SCIURIDAE. Squirrels**Callosciurus erythraeus bonhotei** (Robinson and Wroughton).

Sciurus castaneiventris bonhotei Robinson and Wroughton, Journ. Federated Malay States Mus., vol. 4, p. 234, Nov. 1911. Szechwan.

Three specimens from Yachow, Szechuan, agree in the distinct olive-brown tint above and deep uniform chestnut below, characteristic of this race. There is no midventral line of speckled hair such as some of the other races have. Quite similar is a skin from Wan-hsien in the same province, in the Museum of Comparative Zoölogy.

Dremomys pernyi pernyi (Milne-Edwards).

Sciurus pernyi Milne-Edwards, Revue et Mag. de Zool., ser. 2, vol. 19, p. 230, pl. 19, July 1867. Szechwan, China.

A series of fourteen skins, from Batang (Camp 30), Muliting (Camp 29), Horbo north of Batang (Camp 48), Tunggnolo valley (Camp 5), and thirty miles east of Hokow (Camp 8), all come from a circumscribed area in extreme western Szechuan. The series might represent Thomas's race *griselda* (type from Nagchuka, western Szechuan) but this seems so poorly marked that it is unworthy of subspecific distinction. The ochraceous-buff patch at the root of the tail and behind the ears varies in intensity to a deeper ochraceous rufous. There may be a slight buffy wash over the otherwise white throat, paling out on the belly.

Sciurotamias davidianus consobrinus (Milne-Edwards).

Sciurus davidianus consobrinus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mamm., p. 305, 1868-74. Mupin, Szechwan.

A single skin from Wasukou, Szechuan (25 miles east of Tachienlu), seems typical of this race of rock squirrel.

Tamiops macclellandi swinhoei (Milne-Edwards).

Sciurus macclellandii var. *swinhoei* Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mamm., p. 308, 1868-74. Mupin, Szechwan.

The only specimen of this genus of striped tree squirrels secured by the expedition was captured thirty-five miles west of Hokow (Camp 8) on September 14. It presents an interesting stage of pelage in which the paler winter coat is not yet completely developed. This shows particularly in the case of the black stripes. The median black stripe is as strongly marked as in summer, while the next lateral pair, though become nearly all rusty brown, shows a short section about 15 mm. long at the forward (shoulder) end of each that still remains black with a second smaller black spot farther back on the stripe, about over the hip. The outer pale stripe is wide, of a pale ochraceous buff, and ends at the foreshoulder. The short black stripe which in summer coat borders this pale stripe below, is in the specimen completely changed to pale rusty, scarcely distinct.

Marmota himalayana himalayana (Hodgson).

Arctomys himalayanus Hodgson, Journ. Asiatic Soc. Bengal, vol. 10, p. 777, 1841. Tibet.

Hodgson's types were from Tibet in the region immediately north of Nepal. One of the types I have examined in the British Museum. To this typical form I would refer three specimens from the Tibetan plateau, two of them from Jyekundo (Camp 72), and the third from Camp 79, about fifty miles northeast of that locality. They average paler than specimens from the borders of Szechuan with less admixture of black above, and the ears and sides of the muzzle are a brighter or clearer orange rufous, instead of dull rusty. The black of the area between the eyes is much more mixed with buffy hairs except over the eyebrows which are deep black and tend to form a small distinct patch, somewhat separated from the dark crown by an intervening tongue of mixed buffy and black, thus contrasting with the darker race listed below. No doubt wear and fading may combine to affect the general coloration, but the points above mentioned come out distinctly in series.

Hodgson's "*Arctomys himalayanus*, potius *tibetensis*" is doubtless to be regarded as a synonym of this race, as Blanford long ago pointed out (Journ. Asiatic Soc. Bengal, vol. 44, p. 121, 1875).

An adult skull from Camp 79, fifty miles northeast of Jyekundo, measures: condylobasal length, 98.3 mm.; basal length, 92.6; palatal length, 57.7; zygomatic width, 64.1; mastoid width, 46.6; width across molars, 28.3; upper cheek teeth, 23.8; lower cheek teeth, 22.5.

Marmota himalayana robusta (Milne-Edwards).

Arctomys robustus Milne-Edwards, Nouv. Arch. Mus. d'Hist. Nat., Paris, vol. 7, Bull., p. 92, 1870. Western Szechuan.

Five skins of marmot from Cheto Pass (Camps 1-2), Tsong Ben La (16,000 ft. pass, Camps 26-27), and Litang (Camp 16), on the border of eastern Tibet, evidently represent Milne-Edwards's *Arctomys robustus*, which should be ranked as a subspecies of *Marmota himalayana*. Compared with this race, it chiefly differs in its darker average color, much more mixed with black-tipped hairs over the nape and back, while the dark cap is more marked, extending as a solid blackish patch from the muzzle to the upper eyelids and back nearly to the ears where a sprinkling of buffy hairs occurs on the occiput. The dark eye-brow patch is not separately distinguishable but merges with the dark forehead. The range of this slightly darker subspecies probably covers a narrow area from Batang eastward along the borders of Szechuan.

PETAURISTIDAE. Flying Squirrels**Petaurista clarkei** Thomas.

Petaurista clarkei Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 396, Oct. 1922. Mekong Valley, 28° N., Yunnan.

Two native skins, one with a skull, agree closely with Thomas's brief description. Both are from Batang (Camp 30) but may not have been killed in the immediate vicinity. The head is gray with a prominent spot of ochraceous around the posterior base of the ear; fore part of the back mixed buffy and black, but on the middle and hinder portion of the back the ochraceous-buff annulations of the long hairs become whitish, tipped with black; hands blackish brown, feet blackish. Tail full and long, mixed ochraceous and black. Under side grayish white, faintly washed with buffy; at the sides of the membrane anteriorly is a band of ochraceous buff both above and below, and the extreme edge is marked by a line of whitish, not sharply defined. The skull of No. 17537 is smaller with smaller bullae than in specimens I have regarded as *xanthotis* from Kansu and the Kokonor Mountains. This species was originally described from western Szechuan, but without comparative material it is not possible at this time to determine if the Kansu animal is really distinct. In the Batang skull, the ascending process of the premaxillary tapers dorsally nearly to a point, while in skulls from Kansu it has a broader ending. The dimensions of skull No. 17535 are: occipito-nasal length, 60.5 mm.; palatal length, 33.7; zygomatic width, 36.2; mastoid width, 40.1; width outside premolars anteriorly, 14.8; upper cheek teeth, 16.2; lower cheek teeth, 15.6. The incisors are yellow, not orange. The first upper premolar is a very small spicule, tucked away below the crown of the large second premolar in an angle on the antero-internal side. The molar teeth are fully in place but only slightly worn.

Trogopterus xanthipes edithae Thomas.

Trogopterus edithae Thomas, Ann. Mag. Nat. Hist., ser. 9, vol. 11, p. 658, June 1923. Likiang Range, Yunnan.

A skin from Batang (Camp 30), December 12, 1934, is quite the same as specimens from the Likiang Range, Yunnan, except that the terminal third or more of the tail is black with a few rusty-tipped hairs on the dorsal side except at the very tip. The long erect hairs about the inner base of the ear are a noticeable character. No doubt this should be regarded as a race of *T. xanthipes* of northeastern China.

CRICETIDAE. Hamster-like Mice**Cricetulus alticola tibetanus** Thomas and Hinton.

Cricetulus alticola tibetanus Thomas and Hinton, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 180, Feb. 1922. Tingri, Tibet, 14,000 feet.

A series of nine skins and skulls from Camps 76, 77, 79, 137, north and east of Jyekundo agrees closely with the description of this hamster-mouse, the type of which came from Tingri, Tibet, some distance to the southwest. Adults are nearly uniform pale ochraceous above, with only a very slight admixture of black-tipped hairs, paler, more sandy on the forehead, cheeks and nape. The ears are dusky brown on both proœtote and metentote, narrowly edged with white except at the basal third, and with a small white tuft at the inner base of each ear. The tail is dusky above, pure white below; backs of feet white. The sides of the muzzle and lower cheeks, and the entire ventral surfaces are white with dark slaty bases to the hairs. Immatures are nearly uniform drab gray, the sides washed with pale buffy; ears with their exposed parts blackish brown, white-edged. With advancing age, the buff and ochraceous tints finally predominate.

The precise relationships of this mouse are not clear. It is apparently less pale than *Cricetulus migratorius fulvus* Blanford from Yarkand a thousand miles to the westward, with darker bases to the hair of the lower side, but is doubtless closely related and may prove to be merely a race of *C. migratorius*. No specimen has an all-white tail. The hind foot with claws measures about 17.5 mm. The tail, as measured from the skin, is about 30 mm., and the ear about 16 mm. A skull (No. 17706) shows the following dimensions: condylo-basal length, 25.4; palatal length, 14.5; zygomatic width, 15.6; mastoid width, 12.1; width across molars, 6.0; length of bulla, 6.8; upper cheek teeth, 4.5; lower cheek teeth, 4.8.

Cricetulus lama Bonhote.

Cricetulus lama Bonhote, Abstract Proc. Zool. Soc. London, no. 22, p. 14, Nov. 21, 1905; Proc. Zool. Soc. London, for 1905, vol. 2, p. 305, Apl. 1906. Lhasa, Tibet.

Four specimens of this species were taken at camps 74-79, a short distance beyond Jyekundo to the northward, April 14-18, 1935, an extension of its known range. This is a totally distinct species from *C. alticola*

tibetanus, which occurs at the same localities, although possibly in different situations. It is at once distinguished by its longer tail and hind foot, smaller ears and darker color. The general coloring is much as in less-mature individuals of that species but even darker, with the forehead and cheeks grayish, due to a mixture of black with grayish or very pale-buffy hairtips. Over the shoulders the tint is a more pronounced buffy, while over the back the black hairs predominate. The short ears are hardly distinguishable in color from the surrounding areas of mixed grayish and black. They lack the white basal tuft at the inner side but are minutely edged with white. On the sides, posteriorly, there is a broad tongue of blackish and buffy or russet encroaching on the white of the ventral surface. A similar but nearly black tongue extends down upon the upper part of the hind leg, marked off behind by white and before by another white area. The feet are white; tail dark brown above, white below with a short terminal pencil of both brown and white. Elsewhere the under surfaces are white with deep slaty bases to the hairs. The hind foot with claws measures 17.5 mm.; tail from the skin, about 43; ear about 12. The style of coloring, dark mixed black and buff above and the blackish hip mark set off on both sides by upward extensions of the white of the belly, and the longer and more coarsely haired tail, separate this species at once from *C. alticola tibetanus*.

***Microtus malcolmi* Thomas.**

Microtus malcolmi Thomas, Abstr. Proc. Zool. Soc. London, no. 90, p. 4, Feb. 4, 1911; Proc. Zool. Soc. London, p. 174, 1911. Mountains southeast of Tauchow, Kansu.

Two medium-sized microtines agree very closely with the description of *Microtus malcolmi*, the type of which is from the mountains southeast of Tauchow, Kansu. Hence its discovery in the southeastern corner of Tibet is a considerable extension of its known range. One was captured May 16, at Camp 90; the other on June 10, at Camp 102, on the Chinghai steppes. This meadow mouse is of a distinctly grayish brown, or as Thomas puts it, a brownish "rather lighter than 'bistre'". The under surface has the hairs gray-tipped, with slaty-gray bases. The distinctive characters are: the rather small hind foot, 16-17 mm. with claws; the small ears, about 12-13 mm. in the dried skin; the tail of medium length, about twice that of the hind foot. The skull is rather lightly built, with a distinctly arched profile. The teeth are quite like those of the *M. ratticeps* group, to which this mouse is therefore assignable, but its exact relationships, whether as a race of that animal or a distinct species, must await further study of the group as a whole. The distinctive points are: upper teeth with the pattern of *M. arvalis*, the last upper molar consisting of a transverse space, followed by two small outer and one large inner triangles, then a narrow C-shaped crescent, turned to the inner side. The first lower molar,

as in *M. ratticeps*, is of characteristic form, with a posterior transverse space, then in front of it two large inner and two smaller outer closed triangles, with a fifth inner triangle confluent with a terminal loop. There is a slight indentation of the margin of the inner border of this loop. The second lower molar consists of a posterior transverse space, in front of which are two large inner and two small outer closed triangles.

No doubt this species has a wide range over the eastern part of Tibet to the grasslands of northwestern Kansu. It closely resembles specimens from the Altai region, identified by the late Ned Hollister as *M. obscurus* Eversmann, of which it may be but a geographic race. Typical *M. ratticeps* is apparently a larger species with a similar tooth pattern.

***Microtus (Phaiomys) waltoni* Bonhote.**

Microtus (Phaiomys) waltoni Bonhote, Abstract Proc. Zool. Soc. London, no. 22, p. 14, Nov. 21, 1905; Proc. Zool. Soc. London, for 1905, vol. 2, p. 306, text-f. 53, Apl. 1906. Lhasa.

Two specimens are clearly referable to this mouse, first described by Bonhote from Lhasa, Tibet. The record extends the known range considerably to the eastward. One of them, taken at Camp 76, on June 8, is in long full pelage, of a buffy gray, shading to clear buff on the sides of the neck and on the flanks. This seems to represent the winter pelage, for a second specimen dated July 22, (from Camp 132), has nearly completed the moult to summer coat. Only a small area covering the hind quarters still retains the long buffy hair of winter, while over the rest of the back it is buffy gray, darker on the back and nearly clear buffy on the sides of the neck. The lower surface is lightly washed with pale buffy, hardly concealing the short gray bases of the hairs. The extended hind foot, with claws, measures 20.3 mm.

***Microtus (Neodon) irene irene* Thomas.**

Microtus irene Thomas, Abstract Proc. Zool. Soc. London, no. 90, p. 5, Feb. 14, 1911; Proc. Zool. Soc. London, p. 173, Mar. 1911. Tachienlu, Szechuan.

The small meadow mice of this group are regarded by Hinton as worthy of rank as a distinct genus, *Neodon*, representing in the highlands of western China a more primitive *Pitymys*-like species without the special modifications resulting from fossorial life. As in that genus, the first lower molar consists of a closed triangular lobe in front, succeeded by two opposite and confluent triangles, then one outer and two inner closed triangles and a terminal transverse loop. The small feet thinly clad with short dull whitish hairs, are a distinguishing mark. Of the ten specimens secured, one is from forty miles east of Hokow, on the Yalung, four are from Batang, and the others from farther westward in Khams, at Camps 90 and 136. It is in general a species characteristic of high alpine meadows in this region.

MURIDAE. Typical Mice and Rats**Apodemus latronum** Thomas.

Apodemus speciosus latronum Thomas, Abstract Proc. Zool. Soc. London, no. 100, p. 49, Oct. 31, 1911; Proc. Zool. Soc. London, p. 137, Mar. 1912. Tachienlu, Szechwan.

This species is readily distinguished from its congeners in the same general locality by its larger size and large, nearly naked, blackish ears. The long hind foot measures about 27 mm., the ear from base about 20. It is apparently an inhabitant chiefly of wooded or scrubby areas. The expedition found it common about Batang (Camp 30) where ten specimens were collected, and at other camps between there and Tachienlu in western Szechuan, as at Magidrong (Camp 10), Dakotime, and forty miles east of Hokow. Probably Batang marks nearly the western bounds of its range.

Apodemus peninsulæ (Thomas).

Micromys speciosus peninsulæ Thomas, Proc. Zool. Soc. London, for 1906, p. 862, Apl. 11, 1907. Mingyong, 100 miles southeast of Seoul, Korea.

Four specimens in adult winter pelage from Chinghai, and a dozen others, old and young, from Dawo (Camp 153), Tunggnolo (Camp 5), and Batang (Camp 30), agree so closely in color and size with a series from Kansu, China, and from Korea, that I am unable to distinguish them with certainty. The four from Chinghai, taken April 15, are still in the bright-russet winter pelage, except that on their heads and fore shoulders moulting seems to have begun, so that these areas appear grayer than in more eastern skins. A series from the Tibetan plateau in winter coat, might show that the animal in this area is a slightly paler race. Otherwise this species holds its characters with remarkable constancy over a wide area from Korea across northern China, to Kansu and the eastern part of the Tibetan plateau. It is distinguished by its uniformly colored upper side, of an even mixture of black and russet hairs in summer, with a clearer russet above in winter, only slightly darkened in the mid-back. The ears are clothed with short gray and russet hairs on their exposed surfaces, not contrasting with the surrounding fur. The last upper molar, unless greatly worn, shows three subequal lobes on the inner side.

Although Thomas regarded this as a continental race of the Japanese *Apodemus speciosus*, the latter seems to be a much larger and distinct species.

Rattus norvegicus socer (Miller).

Epimys norvegicus socer Miller, Proc. Biol. Soc. Washington, vol. 27, p. 90, May 11, 1914. Taochow, Kansu.

Two rats, a half-grown young and an older individual, from Batang are of this species and though rather young to show the full development of cranial characters distinguishing this race, doubtless represent the native form, to which they may be tentatively referred.

Rattus confucianus confucianus (Milne-Edwards).

Mus confucianus Milne-Edwards, Nouv. Arch. Mus. d'Hist. Nat., Paris, vol. 7, Bull., p. 93, 1871. Mupin, Szechwan.

The Sulphur-bellied Rat is a common species over most of China, frequenting bushy or partly tree-grown areas in rocky situations. One secured by the expedition at Hokow (Camp 8), on September 16, is still in the summer coat, which is partly spinous. Two other adults are from Batang (Camp 30), while a half-grown young animal from Jyekundo (Camp 72), August 8, is unexpectedly far to the westward of the Chinese border.

ZAPODIDAE. Jumping Mice**Zapus (Eozapus) setchuanus** Pousargues.

Zapus setchuanus Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, p. 13, fig. 1-3, 1896. Tachienlu, Szechwan.

The single specimen in the collection is a male taken in the Anya valley four days' travel west-southwest of Tachienlu, the type locality. It thus extends slightly the known range of the typical race, with which it agrees in the presence of a well-developed yellow line in the center of the white under side. The collector's field measurements are: total length, 180 mm.; tail, 105; hind foot, 28; ear, 12.

MOSCHIDAE. Musk Deer**Moschus moschiferus sifanicus** Büchner. Chinese Musk Deer.

Moschus sifanicus Büchner, Mélanges Biologiques, vol. 13, no. 1, p. 162 = Bull. Acad. Imp. des Sci., St.-Petersbourg, new ser., vol. 2, p. 116, 1891. Southern Kansu.

Several specimens were brought back. According to Mr. Dolan's notes, it is universally distributed throughout the marches of eastern Tibet, with a wide range of habitat from comparatively low altitudes to the highest growth of dwarf rhododendrons. "Its favorite haunts are in rhododendron, spruce, or prickly oak. It is chiefly in such cover that it is trapped by professional musk hunters but its salvation seems to lie in the fact that there is a reserve in higher altitudes where the native hunters cannot trap it profitably."

CERVIDAE. Deer**Elaphodus cephalophus cephalophus** Milne-Edwards. Tufted Deer.

Elaphodus cephalophus Milne-Edwards, Recherches pour servir à l'Hist. Nat. des Mamm., p. 353, pl. 65-67, 1871. Mupin, Szechwan.

The Tufted Deer Mr. Dolan found well distributed "over the marches of eastern Tibet in the lower gorges of the river courses. Its favorite haunt is in poplar and birch forest at altitudes of about 11,000 feet. In such situations it occurs around Batang and Tachienlu in considerable numbers. It is not held in much esteem by the natives and consequently is not much hunted."

Capreolus capreolus bedfordi Thomas. Duke of Bedford's Roe Deer.

Capreolus bedfordi Thomas, Abstract Proc. Zool. Soc. London, p. 32, June 16, 1908.
One hundred miles west of Taiyuan-fu, Shansi, China.

The roe deer of northern China is not very different from the races farther west. The specimens collected at Dzogchen (Camp 145), by the expedition come from what must be very nearly the southern limit of the range in western China. Here, Mr. Dolan writes, they were found "to the northwest of Sungpan, where they are plentiful but hard hunted, and at Dzogchen Lamasery where they occur more sparingly. In no other locality did we find evidence of them, although we heard of their occurrence near the tea road to Lhasa between Tachienlu and Dawo (Tao-fu). In both localities they were encountered in cover of rhododendron and dwarf rhododendron."

Rusa unicolor dejeani Pousargues. Dejean's Rusa Deer.

Rusa dejeani Pousargues, Bull. Mus. d'Hist. Nat., Paris, vol. 2, p. 12, 1896.
Szechwan.

The Rusa Deer is found in suitable country slightly to the north of Tachienlu, southward and westward as far as Batang in China. One fine male from the latter locality has the coarse hair a dark blackish brown, and the legs darker, fuscous, becoming pale ochraceous on the inner sides. In a second specimen consisting of the skull only, (Batang, November 21), the antlers are thick and solid, with a length from the burr to the tip of the front tine, following the outer curve, of 600 mm., or 27.25 inches, only 3.75 inches shorter than the record head listed in Rowland Ward's "Records of Big Game". The circumference above the burr is 225 mm. (8 $\frac{7}{8}$ inches); length of brow tine from the crotch, 235 mm. Other measurements are: condylobasal length, 360 mm.; basal length, 336; palatal length, 217; zygomatic width, 159; mastoid width, 128; nasals, length 143, combined width at widest place, 62; width across molars, 106; upper cheek teeth, 106. The nasals are not notched at the distal end.

These sambar, Mr. Dolan writes, seem to follow the deep river valleys from the south, and occur in the valley of Tachienlu, in the Yangtse valley, and probably in the valley of the Yalung, as well as in the mountains south of Litang. At Batang their favorite grounds were the semi-arid side ditches off the Yangtse, in semi-jungle of wild rose, plum, and other thorny plants, whence they extended their range up into the prickly-oak forest.

Cervus albirostris Przewalski. White-lipped Deer.

Cervus albirostris Przewalski, Reise in Tibet, p. 73, fig. p. 76, 1884. Nanshan.

This large deer was found to be fairly common in the mountainous country above Batang (Camp 30). It is apparently a characteristic species of the plateau region west of the Chinese highlands, from the Nanshan Mountains westward at least to Lhasa. The extremely coarse pelage, rough and harsh to the touch, the somewhat flattened skull, and the antlers with

their lack of a bez tine, are so distinctive a combination that Flerov has suggested a special subgenus, *Przewalskium*, for the species. While the antlers are usually described as having no bez tine, this condition may be interpreted, however, as representing a more primitive stage, in which the inter-node between brow tine and bez tine is still long, and the succeeding inter-node really represents that usually forming the more basal part of the beam. Pocock, however, is inclined to suppose that the bez tine in the elaphine type of antler is an interpolated or extra one, rather than the homologue of a succeeding fork. A large antler secured by the expedition measures $41\frac{1}{2}$ inches (1045 mm.) on the chord from the anterior base of the burr to the tip of the most distant point. Other measurements of this antler are: circumference just above burr, 197 mm. ($7\frac{3}{4}$ inches); length of brow tine on outer curve, 325 ($12\frac{3}{4}$ in.); length of "trez" tine from upper base, 498; length of third point, 337; of fourth, 200. The antlers of this deer seem to show a simple system of forking, in which, after the first fork, the posterior branch only again subdivides in each subsequent bifurcation.

This deer, as Mr. Dolan writes, is "more widely distributed than M'Neill's Deer, and still occurs all the way from the Tachienlu mountains westward into central Tibet and northward probably to the grasslands around the Amnye Machen. They were seen by us to the south of Litang around Batang, and to the northwest of Jyekundo, and tracks were found in the Tachienlu Mountains. However, they have been so persecuted that the stand is down to nothing in many localities. Four or five years ago they were said to have been extremely plentiful around Batang, but a force of Tibetan troops with British military rifles had so far reduced them in a season or two, that we had great difficulty in finding them. They range from mid-spruce forest up through rhododendron and dwarf rhododendron to the grasslands just below the peaks, that is, from about 12,000 to 16,000 feet. They occur on the fringes of the high steppes along the scarps of the upper Yangtse River in dwarf rhododendron and willow cover. These deer are probably also protected by native chiefs and lamaserics in the interior of Tibet, for of thirteen full yak loads of antlers observed by us when they were brought to the market at Jyekundo, about ninety per cent were shed antlers. It is said that the antlers are retained by the deer well through the month of March."

Cervus macneilli Lydekker. M'Neill's Deer. Plates 23 and 24.

Cervus cashmirianus macneilli Lydekker, Proc. Zool. Soc. London, p. 588, pl. 69, 1909; p. 987, Dec. 1910. Tibetan side of Sino-Tibetan border.

Cervus macneilli Lydekker, Cat. Ungulate Mamm. Brit. Mus., vol. 4, p. 145, 1915.

Cervus canadensis wardi Lydekker, Proc. Zool. Soc. London, p. 987, text-fig. 143, Dec. 1910. "Tibet".

One of the outstanding results of Mr. Dolan's expedition was the securing of a series of both male and female adults of the pale-colored M'Neill's

Deer. Described in 1909 on the basis of a hind shot on the Tibetan side of the boundary between Szechuan and Tibet, its true affinities have been obscured by the fact that not only were no others available in collections, but the antlers of the male were unknown with certainty. This state of affairs has now been remedied by the fine series of a dozen specimens of both sexes in the Academy's collection. From these antlers it is at once apparent that *Cervus macneilli* is a strictly elaphine type, perhaps even a race of *Cervus claphus*, but until the whole matter of the relationships of the Asiatic *Cervus* can be carefully reviewed with adequate material, it does not seem yet possible to settle the status of this deer and such little-known ones as *C. wallichii* and its races, *C. cashmirianus*, and others. Nevertheless it is fairly certain, that as Lydekker himself, in 1915, suggested, his *Cervus canadensis wardi*, based on a pair of shed antlers purchased by a missionary in western Szechuan, is after all a synonym of *macneilli*, for the type antlers, which I was privileged to examine at the British Museum, though somewhat larger than the average of *C. macneilli*, evidently represent that animal. The antlers are collected by the Tibetans and traded into China, which doubtless accounts for the fact that the type antlers of *C. wardi* were purchased in Szechuan.

In a preliminary account of the Dolan Expedition's results, Mr. Arthur de C. Sowerby (1936) has published some excellent photographs of M'Neill's Deer, secured by Mr. Dolan, with brief notes on the species. As originally described from the female in the British Museum, the color in summer is very pallid, because of which the Chinese name for it is *pei lu*, meaning "white deer". My notes on the type describe the body as pale, a finely speckled gray and brownish black. The lips and nose are pale drab, not contrastingly white as in the White-lipped Deer. The inner side of the legs is pure white, as is also a narrow rim on the inner side of the buttocks. This latter area is bordered by blackish, which extends across dorsally to include the upper surface of the tail. The winter pelage as represented by Mr. Dolan's skins, seems grayer, with a brownish wash on the back, the throat and sides of the neck a mixed gray. The white pygal area is as narrow as in the summer condition. The antlers of the males when viewed from in front, have the main beam turned inward from the level of the trez tine, in this respect somewhat approaching the condition seen in Wallich's Deer (*Cervus wallichii*). Two immature males from Tsu Tchi are probably in their second year and still retain milk premolars, of which the second and third consist each of four crescents arranged in opposite pairs. Their antlers consist of a simple beam, unbranched, from a low pedicel about 43 mm. high, and have a slight outward curvature then turn in, giving a sigmoid form. In No. 17388, this simple antler is 295 mm. long on one side, and the skull still retains all three milk premolars, while the last permanent molar has not quite reached the alveolar level. In No.

17387, of about the same age, the antlers are a trifle longer, about 365 mm., the diameter of the pedicel just below the burr, 25 mm. In adult males both brow and bez tines are long and well developed, with a light upward curvature; the course of the main beam is then upward and outward, as seen from in front, until the trez tine is reached, situated on the outer side of the beam. The length of the trez varies in the series from a short snag to a much longer up-curved tine, which, however, does not exceed the brow tine in length. At this point the main beam turns decidedly inward, but apparently not so much as it does in *C. wallichii*. In a well-developed set of antlers, the part of the beam above the trez about equals that below it, from trez to bez tine, then the main beam forks in such a way that there is an anterior and a posterior tine, more or less in line, while a third one arises on the outer side, at or just above or below the point of forking, to make a more or less well-marked "cup". There is as usual much individual variation in the development of the several tines, and opposite sides may show considerable asymmetry. One large antler (No. 17378) exhibits the following measurements: length of brow tine from burr, on outer curve, 295 mm.; bez tine, 310; length of beam from upper base of bez to trez tine, 368; length of trez tine from outer side of beam on its curve, 260; length of beam between upper base of trez to the fourth tine 355; anterior tine of the "cup", 295; posterior tine of "cup", 350; lateral tine of "cup", 310. In one specimen, the main beam above the trez does not fork again; in another (No. 17394) the trez is very short, and above it the beam forks, with a long anterior tine, and a shorter posterior one that has a short fork terminally.

The upper canine is well developed in both sexes, but is decidedly smaller in females, only about three-fifths as long. In an adult male it is 15 mm. long by 7.5 in transverse diameter; in an adult female, 9 mm. long by 6 transversely. The cranial measurements of the four largest of each sex follow:

Skull Measurements of M'Neill's Deer

No.	<i>Males</i>			
	17383	17386	17394	17396
Condylbasal length	350	387	370	353
Basal length	330	357	352	326
Palatal length	210	230	232	216
Length of nasals	125	145	144	129
Combined greatest width of nasals	48.5	54.7	63.5	46.7
Zygomatic width	159	152	160	152
Width across orbits above	141	130	157.5	139
Width across molars	102	101.5	112	101
Upper cheek teeth	109	119.5	112	114
Lower cheek teeth	124	136	126	—
Upper premolar row	49.5	52	50	50

Females

No.	17380	17381	17390	17391
Condylbasal length	361	364	363	364
Basal length	338	353	342	350
Palatal length	222	224	213	228
Length of nasals	133	147	133	137
Combined greatest width of nasals	52	47	55	47
Zygomatic width	143.5	144	141	146
Width across orbits above	138	137	132	135
Width across molars	107	101	103	103
Upper cheek teeth	103	115	115	108
Lower cheek teeth	115	125	122	121
Upper premolar row	45	49	51	46

Concerning McNeill's Deer, Mr. Dolan writes that it occurs "in the marginal forests of the Mekong, Yangtse and Yalung ranges, usually above 12,000 feet, in heavy growth of rhododendron. It is now very scarce in the vicinity of Litang, where the first specimen was taken by Captain McNeill, and the expedition saw no evidence of it there except antlers and velvet shown to us by the merchants, and said to have come from deer killed in the vicinity, although they might well have come from far away. We collected them in March of 1935, two days west of Jyekundo. A stag observed had not yet shed its antlers. Schäfer later collected others in the Mekong drainage southwest of Jyekundo, and in September found them most plentiful near the monastery of Dzogchen, not far from Derge on the Yalung watershed. The big stags were about to shed their velvet, but the younger stags were in full velvet, with their antlers still soft. The skins taken in September were in clean summer hair. These deer have been much persecuted by the natives for the aphrodisiac properties believed by the Chinese to be inherent in antler velvet. They were probably once plentiful over most of eastern Tibet. At the present time they are protected by the monastery at Dzogchen, and we heard in Jyekundo that native chieftains protect them to the west of that place."

BOVIDAE. Antelope, Sheep, Cattle

Naemorhedus goral griseus Milne-Edwards. Gray Goral.

Nemorhedus griseus Milne-Edwards, Nouv. Arch. Mus. d'Hist. Nat., Paris, vol. 7, Bull., p. 93, 1871. Mupin, Szechwan.

The Gray Goral Mr. Dolan found "universally distributed in the river trenches between altitudes of 300 or 400 feet up to above 11,000 feet. Specimens were collected in the valley of the Min, near Wenchwan; in the Wassu country; at Waszekou, junction of the Tachienlu and Tung Rivers; at Hokow on the Yalung; and below Batang on the Yangtze. These little animals can be extraordinarily plentiful as on the cliffs above the Tsaopo River which drains the Wassu country. In the valley of the

Min we shot a buck which was browsing within one hundred feet of a band of domestic goats. On the other hand they can be extraordinarily shy where they are much hunted by natives, who almost invariably drive them with dogs."

Capricornis sumatraensis milne-edwardsii David. Serow.

Capricornis milne-edwardsii David, Nouv. Arch. Mus. d'Hist. Nat., Paris, vol. 5, Bull., p. 10, 1869. Mupin, Szechwan.

Several specimens of the serow were brought back. Of this animal Mr. Dolan notes that they are found "throughout the marches of eastern Tibet wherever, figuratively speaking, there is vegetation as high as their heads. They doubtless occur also in the trenches of the Mekong and the Salween, perhaps also of the Brahmaputra. There is great variation in color, which may account for the division into the two forms now recognized. We have seen them in conditions varying all the way from a thick white mane to a condition without mane, showing only the blackish body color on the neck. The under parts were found to vary from orange red to yellow buff. As regards habitat, they are one of the most adaptable of large mammals, occurring wherever vegetation is dense enough to afford them shelter. We found them most numerous at Tachienlu in heavy rhododendron jungle and at Batang in forests of prickly oak (*Quercus ilex*). However, in the neighborhood of Tachienlu, a specimen was collected at 13,000 feet in low juniper scrub. Near Batang they went as high as 13,500 feet. They feed chiefly at night, but may be seen abroad in the late afternoon or early morning. During the daytime serows occupy 'stalls' under the shelter of a cliff or overhanging rock. That they use such 'stalls' over long periods is attested by the accumulation of droppings, sometimes more than a foot deep. When frightened they 'blow' shrilly."

Procapra picticaudata Hodgson. Tibetan Gazelle.

Procapra picticaudata Hodgson, Journ. Asiatic Soc. Bengal, vol. 15, p. 334, pl. 2, 1846. Hundes district, Tibet.

Pocock (1910) in reviewing the cutaneous scent glands of ruminants, writes that if Hodgson be correct in stating that this gazelle lacks both preorbital and inguinal glands, it differs from all the true gazelles, and in addition has apparently smaller pedal glands. "In view of the constancy in occurrence and development of the cutaneous glands in the species of *Gazella*" he has examined, he is "disposed to think that *Procapra* should be admitted as a valid genus". While it is difficult in tanned skins to make certain of the presence or absence of glands, those I have examined seem to bear out Hodgson's statement; at least the preorbital gland if present must be very small, and has no corresponding antorbital pit in the skull such as is found in *Gazella*, nor was I able to make out any certain indication of inguinal glands. Another point, not mentioned, is that in *Gazella*

the nasals are short and broad, with a notch in their anterior border, whereas in *Procapra* the nasals are long and both taper to a median point. The slender and slightly sigmoid horns of this species have a wider backward sweep than in *Gazella*.

This is a characteristic species of the plateau country from the western borders of Szechuan across Tibet, to Ladak. Mr. Dolan writes that it "occurs as far south as four days below Batang and an undetermined distance south of Litang, and as far east as Sungpan. The kids are dropped probably in late June."

Pantholops hodgsoni (Abel). Chiru.

Antelope hodgsoni Abel, Edinburgh Journ. Sci., p. 163, 1827. Hundes district, Tibet.

The chiru is a highly characteristic antelope of the Tibetan plateau, occurring from eastern Tibet to Ladak and Yarkand. Several specimens were brought home by the expedition.

Mr. Dolan states that "the chiru have been persecuted like the yak and have withdrawn from the large areas formerly occupied by them to the wildest part of the high steppe. Their horns are much in demand for prongs to the forks which the Tibetans use as supports for their rifles. Schäfer encountered them only once while traveling for weeks over country where they were formerly plentiful. That was on the high steppes of the upper Yangtse, southeast of the Kukuschili range. In July they were in full moult, and the bucks in bands together. Their range in altitude coincides nearly with that of the wild yak, although they seem to occur lower on the Turkestan side of the Kuenlun Range."

Pseudois nayaur szechuanensis Rothschild. Blue Sheep.

Pseudois nahoar szechuanensis Rothschild, Ann. Mag. Nat. Hist., ser. 9, vol. 10, p. 231, Aug. 1922. Szechwan (mounted skin) and Shensi (skull).

Pseudois nayaur caesia A. B. Howell, Proc. Biol. Soc. Washington, vol. 41, p. 118, June 29, 1928. Archuen, Minshan Mts., Kansu.

In briefly describing the Szechuan Blue Sheep, Lord Rothschild designated two cotypes, a mounted skin with horns from Szechuan, doubtless the western border, and a skull from Shensi. Six years later, Howell, overlooking Rothschild's paper, gave the new name *caesia* to a specimen from the Minshan Mountains, 140 miles south of Lanchow, Kansu. Presumably the Blue Sheep of Szechuan, Kansu, and Shensi are representatives of the same race, so that *caesia* becomes a synonym of *szechuanensis*, but lest in future, there may arise question as to the possible validity of the Kansu animal, I would here designate the mounted specimen from Szechuan in the British Museum as the lectotype of the race *szechuanensis*.

The status of this race is still not wholly made out. The color pattern varies not only with age and sex but individually, so that little reliance may be placed on the published descriptions as indicating race characters. Probably the most important character is that the tips of the horns in adult

males are usually straighter, curving directly backward instead of turning in at the points; but no doubt there is variation in this respect, for one large set of horns from Szechuan resembles the typical *nayaur* while others are typical of the eastern race. Mr. Dolan brought back a splendid series of skins and skulls from the western Chinese border, representing all ages from immature to adult. A brief statement of the color in this series and their stages of development seems worth while.

No. 17454, adult male, Drupalong south of Batang, Szechuan, January 8. —This is the largest animal of the valley series. The short stiff hairs on the top of the muzzle from nosepad to level of eyes, blackish with scattered minute buffy tips to some of the hairs; the buffy tips increase in length between the eyes and on sides of the face in front of and below the eyes giving a mixed buff and black appearance. A broad clear-buff area borders the upper eyelid and extends forward along the side of the muzzle, sharply marked off above in front of the eye by the blackish line of the dark forehead and muzzle. Cheeks grayish anteriorly. Occiput, neck and entire back to shoulders, flanks and upper haunches, drab. The coarser hairs of the back are about 40 mm. long, and under a lens appear grayish white with a narrow stripe of dark brown on the front and back. These stripes merge at the tip of the hair or are interrupted by a subterminal band of buffy. Along the sides of the neck and across the fore shoulder the bases of the hairs are paler,—white tinged with gray,—and with broad buffy tips giving to this area a warm-buffy tint, which extends across the lower sides of the flanks as a narrow stripe bordering the black flank stripe to the groin.

On the lower throat the pale-based hairs become broadly tipped with deep black, to form a median black patch. A black stripe about 20 mm. wide extends along the lower flanks from just behind the axilla all the way along the inner border of the thigh and down the front aspect of the hind leg to the foot, broadening at the ankle to send a narrow projection up along the outer side of the tibia, and again more distally to send a broad extension to each of the lateral hoofs. The outer side of the fore legs is similarly marked, with a broad black stripe on the anterior aspect of the limb, from about the middle of the humerus to the hoof, forking to send extensions to the lateral hoofs. A wide pale-buffy mark interrupts this stripe at the knee, extending from the whitish inner surface of the leg nearly across the black area. Backs of the ears colored like the nape, but the inner surface lined with white hairs. Tail black above and terminally below, with buffy to whitish sides and base below.

No. 17449, adult male, Leh (south of Batang), Szechuan, November 15. —Similar but the dark mark on bridge of muzzle less extensive, face and eye-ring paler gray, less buffy; buffy tips to the body hairs less worn and broken away, so that the general tint is more buffy. No black lateral stripe; hind-leg stripe begins at about the head of tibia and extends to the hoof.

No. 17457, immature male, Drupalong, January 3.—Face mixed whitish and dark; eye-ring and its anterior extension whitish; very little remains of the buffy hair tips on the body. No black lateral stripe, though many of the hairs below the buffy flank stripe are dark tipped. Black chest-mark small. Pelage soft, not harsh as in adults.

No. 17453, adult male, Leh, December 8.—Nose patch not well marked but much mixed with buffy-tipped hairs; eye-ring white. Middle of throat with many black-tipped hairs. Fore-leg stripe completely interrupted at the knee. No lateral black stripe, although it is indicated in the middle of the flanks by a clouding of dark tips to the hairs. Hind-leg stripe, clear and black from the groin.

No. 17460, immature female, Drupalong, January 3.—No side stripe of black but the buffy flank stripe is obvious; both fore- and hind-leg stripes are so mixed with buffy-tipped hairs all the way to the hoof as to be nearly obsolete. Fore-leg stripe interrupted at the knee.

From the foregoing brief descriptions of selected skins, it is evident that the general tint of the body varies slightly, according to the amount of buffy tips present, and these are subject to wear and breakage, which results in a more drab appearance. The lateral black stripe varies even in adults, and is normally absent in the immatures, while the leg stripes may be partly mixed with the buff of the body. The fore-leg stripe may be completely or only partly interrupted at the knee. Old males have more black on the lower throat.

On arranging the skulls in series according to age, it is seen that in the immature animals, probably two years old, the frontals are beginning to fuse together anteriorly along their line of contact. In the more advanced of these, the frontals are united except for a few pore-like deficiencies, to within a centimeter of the nasals, and posteriorly nearly to the parietal suture on the posterior aspect of the skull. In the next stage the frontals unite with the bases of the nasals and then the nasals themselves unite proximally along the median line, while at the same time the upper border of the lacrymal fuses with the outer edge of the frontal against which it abuts. With increasing age these sutures close completely and the bones become thicker and heavier to support the horns.

The longest pair of horns, as measured on the outside curve beginning at the inner angle, was 595 mm. In the following list are the horn lengths of the four next largest heads with complete dentition, followed by four which are immature males of slightly varying age, but still retaining the milk premolars. The horns of the female, even when adult are short and nearly erect. All in this list are from the Yangtse gorges where no very large heads were secured.

Horn Measurements of Blue Sheep

No.	Right side	Left side	Age and sex	Place
17454	475	(405)	adult male	Drupalong
17449	400	405	" "	Leh
17455	327	330	" "	Drupalong
17452	330	347	" "	Leh
17458	205	197	immature male	Drupalong
17457	162	157	" "	Drupalong
17448	150	143	" "	Leh
17456	102	105	" "	Drupalong
17461	125	127	adult female	Drupalong

The widest spread of horns in this series is 585 mm. from tip to tip in No. 17454, but in a specimen from the same region, No. 29958 Mus. Comp. Zoöl., it is 715 mm. In the young animals, the tips of the horns do not become ringed nor does the keel develop until they are about 60 to 65 mm. long. Other cranial measurements are given in the annexed table.

Cranial Measurements of Blue Sheep

No.	Condylor-basal length	Basal length	Palatal length	Zygomatic width	Mastoid width	Width across molars	Upper tooth-row p2-m3	Upper dp2-4
29958MCZ .	235	215	131	141	90	65	65.8	—
17454	220	203	121	138	84.6	63.8	65.0	—
17449	210	190	115	131	73.7	61.5	66.3	—
17455	208	191	113	125	78.8	62.0	66.0	—
17458	187	171	104	109	67.9	52.6	—	56.7
17457	193	177	105	113	74.3	56.0	—	58.5
17448	180	161	100	109	68.4	51.8	—	52.8
17456	189	171	107	111	69.4	51.8	—	52.5

An interesting detail in the distribution of this sheep was found. At Leh and Drupalong, in the deep gorge of the upper Yangtse River, Blue Sheep were encountered that appeared smaller with less heavy horns as compared with those of the upper grassy altitudes of the same region. A zone of thick scrubby forest three or four miles across and covering about fifteen hundred feet of altitude, intervenes between these ranges, so that the sheep of the uplands seem more or less cut off from those living in the gorges at the lower elevation. Both Dolan and Schäfer, who collected a series of each, were inclined to believe that the animals of the gorges represented a separate and depauperate race, as mentioned casually by Sowerby in his paper on their expedition. After a careful comparison of the specimens, however, it appears that the lowland animals are mostly immature,

and with one possible exception, younger than the big males of the upland pastures. Thus the smaller size is in part attributable to immaturity, but at the same time the less robust horn cores and horns may result from sparser pasturage. Only one of this valley series has the frontal and nasal outlines fairly well obliterated and its teeth well worn; its horns have the battered appearance of old rams but are smaller than those of equally battered upland rams. Selecting what seem to be comparable skulls of each group, those of the valley sheep run slightly smaller in some dimensions such as total length or diameters of the horn cores, but the gaps are bridged by individual variation and it does not seem possible to point out any certain distinctions. If the sheep of the gorges are really an isolated group, it is quite likely that they may not attain the size of the upland rams. That they can be regarded as a separate race, however, does not seem to follow, nor is it altogether clear that the forest belt between gorges and uplands constitutes a complete or impassable barrier.

Mr. Dolan notes further, that in the marches of eastern Tibet the Blue Sheep is well distributed from altitudes of 12,000 feet upward, depending upon rainfall. In the neighborhood of Tachienlu herds were seen in the autumn numbering as many as two hundred animals, including ewes, lambs and rams up to five or six years old. The oldest rams, however, were almost invariably seen alone or in partnership. Lambs are dropped in early May.

Ovis ammon hodgsoni Blyth. Hodgson's Sheep.

Ovis hodgsoni Blyth, Proc. Zool. Soc. London, p. 65, 1840. Tibet; probably the northern frontier of Nepal.

Several fine specimens from the extreme upper waters of the Yangtse in Chinghai (Kokonor, Tibet) doubtless represent typical *Ovis ammon hodgsoni* and agree with Lydekker's diagnosis of that race in having the horns less everted than in typical *ammon* of the Semipalatinsk, Altai, "the descending portion nearly vertical, the front outer angle often distinct, and the whole forming about one complete circle."

The largest male collected had thick heavy horns, but these do not equal in length the maximum of 48.5 to 57 inches mentioned by Lydekker, attaining only 34.5 inches (1020 mm.) on the outer curve, with a girth at base of 416 mm. Other measurements of this skull are: occiput to tip of premaxillaries, 365 mm.; condylobasal length, 340; basal length, 318; palatal length, 172; width across orbits dorsally, 215; width across zygomatics, behind orbits, 145; occipital shield 195 mm. high by 130 broad; length of nasals, 155 (c.); width across first upper molars, 79; upper cheek teeth, 95; lower cheek teeth, 97; three upper molars together, 67; three lower molars together, 68.

Mr. Dolan writes that this sheep was first found on the steppe of Seshu (Camp 61), where they inhabited island-like ranges of granite rising from the steppe. Skulls and old sign were seen here. Later, specimens were collected west of Drechu Gomba (Camp 79) and farther west on the Chang Tang. Sheep were seen also on granite ranges north of Tossun Nor on the steppes of the upper Yellow River in Kokonor. Two large solitary rams were seen in May, and in July rams and ewes were found in separate bands on the mountains of the high steppe northwest of Jyekundo.

Poephagus grunniens mutus Przewalski. Wild Yak.

Poephagus mutus Przewalski, Journey in Tibet, p. 190, fig., 1883.

In the account of his third journey in Tibet, the Russian explorer Przewalski named the wild race, and gives its range as from Kharakhorum eastward along the Kuenlun to Altyn Tagh and the Nanshan range, becoming less rare in the valleys of the last. Pousargues (1898) adds that it is found also in the region of the sources of the Yangtse, but it avoids the Kokonor basin and the salt steppes of Tsaidam. It was met with by Mr. Dolan's expedition in the region of the Chumar branch of the upper Yangtse where two magnificent males were shot. Since measurements of the wild race are few, the following dimensions of the skulls of these two animals are given:

No.	17310	17311
Tip of premaxillaries to vertex of skull	610	576
Condylbasal length	555	540
Basal length	528	506
Width across orbits on dorsal surface	285	240
Width across zygomata behind eyes	235	225
Length of nasals	255	230
Combined width of nasals	97.5	81
Height of occiput, from foramen magnum to vertex	230	192
Width of occipital shield	252	250
Greatest spread of horns	810	735
Distance from tip to tip of horns	460	210
Width outside first molars	140	136
Upper cheek teeth, alveolar row	130	154
Upper molars alone	76	91.3
Lower cheek teeth, alveolar row	140	150

The wild yak bulls attain a huge size, considerably greater than the domesticated type. A brief account of the animal and its pursuit has already been published by Schäfer (1937), who gives the total length of a large specimen collected, as 368 cm., height at shoulder 203 cm. Mr. Dolan writes that its range seems to have steadily shrunk in recent times "due to unceasing hunting by nomads living on the fringe of the high Tibetan desert. Skulls and bones litter the steppes of the upper Yellow River, but the yak have not been common there for a decade so far as we could deter-

mine. The nomads in recent years have obtained European rifles and ammunition, and the military ammunition wounds three animals to every one brought down for meat and coat. Schäfer saw yak only three or four times in the course of six weeks' travel on the steppes of the upper Yellow River and the Yangtse. In July the animals were in full moult. During the summer the cows and calves were together in herds. The mature and older bulls may be in small bands or alone. Its range is from 14,000 feet to 17,000 feet or higher."

EQUIDAE. Horses

Equus hemionus kiang Moorcroft. Tibetan Wild Ass.

Equus kiang Moorcroft, Travels in Ladak, vol. 1, p. 312, 1842. Tibetan plateau.

Asinus hemionus kiang Schwarz, Der Zool. Garten, vol. 2, p. 93, 1929.

In the paper quoted above, Dr. Schwarz has reviewed the Asiatic wild asses, of which he recognizes six valid forms, all subspecies of *hemionus*. He regards *Asinus* as a valid genus, and includes the synonymy of each race. Typical *hemionus* is the race of the Gobi eastward of the Great Altai to Transbaikalia; the race *kiang* is the form of the Tibetan plateau from Kokonor in the northeast to the sources of the Indus in the southwest. Other races replace these to the southwestward. According to Schwarz, the race *kiang* is in point of size, nearest to the Mongolian *hemionus*, differing from it only in the darker, more reddish color of the rump, correlated with the greater paling of the markings and the almost white legs. The blackish-brown hoof stripes are wide and the narrow spinal stripe, about 40 mm. wide, shows no trace of a pale border.

This wild ass was common on the Tibetan plateau.

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EXPLANATION OF PLATES 21 TO 24

PLATE 21

A steppe bear (*Ursus arctos pruinosus*) killed March 18, hibernating in a shallow excavation near Waterh (Camp 62), open Chinghai steppe.

PLATE 22

The lightest color phase of the steppe bear.

PLATE 23

An adult stag of M'Neill's Deer (*Cervus macneilli*), velvet ready to peel, killed September 5, 1935, in dwarf rhododendron cover high in the mountains, southwest of Dzogchen Gomba (Camp 145).

PLATE 24

Rhododendron thickets at 14,500 feet in the mountains southwest of Dzogchen Gomba. Habitat of M'Neill's Deer.

A NEW RODENT OF THE GENUS *RHEOMYS* FROM CHIRIQÚÍ

BY ROBERT K. ENDERS.

Swarthmore, Pa.

Among the mammals collected on an expedition in the Province of Chiriquí, Panama, in 1937, under the auspices of the Academy of Natural Sciences of Philadelphia and Swarthmore College, aided by a grant from the American Philosophical Society, is

Rheomys hartmanni new species.

Type: Female, adult, skin and skull, A.N.S.P. No. 18329, collected by Robert K. Enders, March 17, 1937, at the hot springs on Rio Cotito, Province of Chiriquí, Republic of Panama, at an elevation of 4900 feet. Original No. 2091.

Distribution: Known only from the type locality.

General characters: A small semi-aquatic mouse resembling *Rheomys raptor* more closely than *R. thomasi* or *R. underwoodi*. Ears relatively larger, hind foot relatively smaller than in other members of the group. Tail white tipped, not heavily haired. Pelage short, fine. Fringe around toes of hind foot not very conspicuous; sole of hind foot sepia rather than black. Brain case flat, not rising much above level of nasals, depressed posterior to orbits. Nasals somewhat wider anteriorly, markedly wider posteriorly, then extending as a narrow median tongue 2.3 mm. long, ending well posterior to the premaxillæ. Interpterygoid fossa deep, rounded rather than elongate. Anterior palatine foramen fairly uniform in width throughout length, not wider posteriorly and narrower than in *R. underwoodi*. Tympanic bullae heavier, narrower than in *R. thomasi* or *R. underwoodi*. Lower jaw proportionately heavier; lower incisor teeth shorter, heavier, somewhat laterally compressed. Masseteric ridge well developed.

Color of type: Upper parts uniformly mixed black and cinnamon very finely grizzled; under parts pale silvery grey. Guard hairs not conspicuously longer than under fur; both plumbeous basally. Pelage iridescent in sunlight, bronze under electric light. Vibrissæ greyish. Tail not bicolored dorso-ventrally; not thickly haired; white tipped. Upper surface of metacarpus sepia, outer surface sepia. Upper surface of metatarsus sepia, fringing bristles greyish white.

Skull: Small, flat; frontal region depressed somewhat like *Icthyomys soderströmi*; auditory bullae heavy, narrow. Dorso-lateral occipital region inflated, broad external occipital crest lying between depressions in occipital.

Measurements: Total length 212 mm., tail vertebrae 104, hind foot 25, ear from notch to crown 11. A young adult female topotype: 187; 88; 24; 10. Skull: (type) Length 27.4 mm., zygomatic breadth 14.3, nasals 11.9, interorbital breadth 4.1, incisive foramina 5.

Remarks: *Rheomys hartmanni* is clearly separable from *R. underwoodi* and *R. thomasi*, which occur in Costa Rica and El Salvador respectively. A single specimen of what is tentatively classified as *R. underwoodi* was taken on El Volcán de Chiriquí at a distance of less than twenty miles as the crow flies from Rio Cotito. The type specimen was taken in a meat baited trap set in the water under a log jam; the topotype in a trap set at the edge of the same stream a few hundred yards farther down. The stomachs were empty: the animals had a strong fishy odor. Small fish are abundant in the stream where the specimens were caught. The species is named after Alois Hartmann, whose knowledge of the country and its fauna contributed greatly to the success of our work in Chiriquí.

Specimens examined: Two from the type locality.

**ADDITIONS TO OUR KNOWLEDGE OF AFRICAN LEECHES
(HIRUDINEA)**

BY J. PERCY MOORE

The leeches of Africa are less well known than those of any of the great continents. Except for the African border of the Mediterranean, the Nile drainage, parts of South Africa and a few points in East Africa, publication concerning them was, until very recently, nearly non-existent and for no region is it possible to draw up a list of species that approaches completeness. The present paper adds to our knowledge of those especially of East and Central Africa and is based upon a number of small collections that have been accumulating for several years. These have come through The Academy of Natural Sciences of Philadelphia, the British Museum of Natural History, the American Museum of Natural History, the United States National Museum, and l'École de Médecine Vétérinaire, Brussels, to the authorities of all of which I am thankful, and a few specimens contributed by individuals to my own collection. To Mr. C. C. A. Monro of the British Museum, especially, am I under obligations for directing to me the important collection made by Mr. S. R. B. Pask on Dr. C. Christy's Expedition to Lake Tanganyika in 1926-27. The two expeditions of Dr. E. B. Worthington, namely: the Fisheries Survey of Lakes Victoria and Albert in 1927-28 in association with Mr. Michael Graham, and the Cambridge University Expedition to the East Africa lakes in 1930-31 also yielded valuable collections. From the same source came also some material from the Omer-Cooper Abyssinian Expedition of 1926, most of which has already been studied and reported upon by Harding (1932) and a number of small lots from scattered localities mostly in East Africa. Just in time to be included in this report have been received six vials of leeches collected by Miss C. K. Ricardo in Northern Rhodesia. Of the material contributed by museums in the United States, the most useful collection was that of the Lang-Chapin Congo Expedition in 1909-15 of the American Museum of Natural History, supplemented by several vials of leeches collected by Dr. Joseph Bequaert on the Harvard University African Expedition in 1926-27. Additional scattered specimens came from the several museums named above.

Some technical assistance in the preparation of sections became available through a grant from the Faculty Research Fund of the University of Pennsylvania. To Mr. Herman Walters I am indebted for help in making photographs.

Full data covering the Christy-Pask station numbers were furnished with the collection. Those relating to the Graham Expedition were published in official reports by Mr. Graham and Dr. Worthington in 1929. For Dr. Worthington's Cambridge Expedition, full information concerning both the fauna and flora and the ecological conditions in the several lakes and swamps will be found in a series of papers under the general editorship of Dr. Worthington published in the *Journal of the Linnean Society* for 1932 (Vol. XXXVIII). Among the most useful of these are a General Introduction and Station List by Dr. Worthington and two articles by L. C. Beadle on the Bionomics of East African Lakes and on the Waters of some East African Lakes in Relation to Fauna and Flora. The general characteristics of the lakes, swamps and channels, and detailed data relating to the collecting stations are recorded therein. Reports covering the Lang-Chapin Expedition appear in the *American Museum Journal* for 1910 (Vol. X) and subsequent years. Other references will be found in the bibliography.

This paper was practically completed in 1933 but in the hope that several expeditions to Africa then in the field or projected might furnish material to supply inadequacies or to settle some doubtful points, publication was postponed. Unfortunately this hope was unfulfilled and, with the exception of the data resulting from the study of Miss Ricardo's collection and some additional dissections and sections of old material, little has been added.

In the meantime several papers dealing with African leeches have appeared, making necessary some revision of the text, chiefly in nomenclature and the discussion of synonymy. The most important of these is Augener's *Hirudineen aus Deutsch-Sudwestafrika* (1936) which adds four new species and some valuable discussion of others. A more ambitious paper is Sciacchitano's *Sanguisughe del Congo Belga* (1935), based upon the extensive collections of the Congo Museum, which names no less than 21 species and subspecies as new. Unfortunately nearly all of the accompanying figures are so inadequate and the "descriptions" so brief and undiagnostic, consisting chiefly of a statement regarding general color and size, that I have been compelled regretfully to ignore them as unrecognizable and practically as *nomina nuda*. Several other short papers by Harant and Sciacchitano are referred to in the text and listed in the bibliography. The first part of Autrum's important systematic revision of the Hirudinea has come just in time to permit the acceptance of some of his conclusions regarding generic limitations.

A section discussing the faunal relations of African leeches, with lists of species so far recorded from each of the lakes, river systems, and principal areas was nearly completed to form part of the paper as originally planned. However, the conclusion was reached that, in view of the inadequacy of our

knowledge of the leech fauna of so much of Africa and of the uncertainties due to the indeterminate descriptions of so many species, this would have little significance at the present time. Consequently, it has been omitted.

The location of types is indicated, most of them being in the British Museum of Natural History; duplicates and paratypes, when available, have been placed in the Academy of Natural Sciences of Philadelphia. The collection data are quoted directly from labels accompanying the specimens, occasionally amplified to show the general geographic area, and sometimes with additions from correspondence when available.

GLOSSIPHONIDAE

Glossiphonia disjuncta new sp. Plate 25, fig. 1.

G. heteroclita, Harding 1932, p. 81.

G. weberi, Moore 1933, p. 298.

? *Clepsine namaquaensis* Augener 1936, p. 388.

A small species of the *G. heteroclita* group.

Type and largest specimen measures in mm.: Length 6.6, width 3.7 and depth 1.7, the diameter of the caudal sucker being .9. It has the form of a strongly contracted *G. heteroclita*, broadly ovate with the maximum width far back and the cephalic third relatively slender. A smaller extended specimen measures 10. x 1.3 x .5, the sucker .5 mm.

Cephalic sucker very small, with the minute pore-like mouth close to its center. Eyes 3 pairs, arranged in a triangle as in *G. heteroclita* but those of the 1st pair relatively larger than in that species. First pair of eyes far back from the cephalic margin on IV, well separated from the 2nd pair, directed forward and the two close together; eyes of 2nd and 3rd pairs crowded together on V in a common pigment mass on each side, the 2nd directed forward and outward and the 3rd backward and outward and the fellows of both pairs widely separated. Gonopores separated by 2 annuli, the ♂ at XI/XII and ♀ at XII *a2/a3*, thus agreeing with the usual position in the genus including the related *G. annandalei* and *G. cruciata* but differing from other species of the *heteroclita-weberi* group in which they have a common opening. ♂ pore easily seen but the ♀ not apparent in surface views, the determination having been made on sections. Caudal sucker very small.

Annulation: Not worked out in detail but apparently as in *G. heteroclita* and *G. weberi*. Papillation more closely resembles the latter. On each annulus of the middle region there are about 22 papillae in a transverse row. On *a1* these are all small except the median; on *a2* median, paramedians and intermediates are enlarged and on *a3* median and outer paramedians. Thus there are 7 series of larger conical papillae, the median forming an irregular line on all annuli but largest on *a2* and smallest on *a1*, the somewhat smaller paramedians and intermediates confined to *a2* and the outer paramedians to *a3*. Color faded, but narrow light and dark lines on the dorsum define the longitudinal muscle bundles.

Anatomy: So far as studied the internal anatomy generally agrees with that of *G. heteroclita*. The salivary glands are diffuse and there are 6 pairs

of simple gastric caeca. Testes 6 pairs, ♂ ducts differ from those of *G. heteroclita* only in the larger and more coiled sperm vesicles (epididymes). There is no duct connecting the ♂ orifice with the vagina which is a simple tube rising vertically from the ♀ orifice to receive the oviducts.

The type and 2 others, one bearing several young, were taken at Worthington's station No. 716 in shore weeds at Bufundi on Lake Bunyoni, Uganda, Aug. 16, 1931. Also Omer-Cooper Abyssinian collection, Wourambouchi, Oct. 5, 1926, and in a water hole north of Make River, Abyssinia, Nov. 28, 1926. Type in British Museum of Natural History.

In the preliminary examination this material was identified as *G. weberi* Blanchard because of the much larger cutaneous papillae which distinguish that species from *G. heteroclita* and so reported in the list of species in the Worthington collection (Moore 1933, p. 298). Harding (1932, p. 81) had previously listed *G. heteroclita* among the leeches of the Omer-Cooper collection and presumably had this species. These errors of identification are easily made, as, owing to the strong contraction and poor preservation of the material, the ♀ gonopore is invisible in surface views and as the ♂ pore is large and conspicuous one is led to assume that the two are united as in other species of the *heteroclita* group. Sagittal sections, however, clearly show the ♀ pore 2 annuli behind the ♂. The 1st pair of eyes are larger and less completely united than in *heteroclita* so that the triangular ocular figure is less perfect. Furthermore in young examples the 2nd and 3rd eyes are less completely coalesced than in the adults and present a more serial pattern more as in *G. complanata*. These facts indicate that the present species is intermediate between *heteroclita* and the more typical species of *Glossiphonia* and justify the retention of this group within the genus.

When Augener's description of *C. namaquaensis* appeared I was at first led to accept his name for my species also, but a careful comparison with his description shows considerable differences in the arrangement of the dorsal papillae. This, combined with the lack of information regarding annulation, the position of the gonopores, and the internal anatomy, makes it expedient to wait for further information, though I rather expect that the two will prove to be identical.

Helobdella conifera (Moore). Plate 25, fig. 2; pl. 26, fig. 18.

Glossiphonia conifera Moore 1933, p. 297.

Helobdella conifera, Autrum 1936, p. 30.

A small species having the size, form and general aspect of *G. fusca* Castle. The type measures in mm.: Length 4.5, to ♂ pore 1.1; widths, at oral ring .7, at ♂ pore 1.4, at XIX (maximum) 2.5, at anus .8; depths at same points, respectively, .3, .4, .6 and .4; diameter of caudal sucker .8. The paratype is slightly shorter, narrower and deeper, with a sucker of the same size.

Form broad ovate, strongly depressed, tapering to the small head, broadly rounded caudally. Anterior sucker small, with the lip broadly rounded and closely studded round the margin with goblet organs. Its cavity rather deep, with well-marked rim all round. Mouth a conspicuous pore just anterior to its center in somite III, ventral to the eyes. Eyes one pair on the caudal half of the larger anterior annulus of somite III, the pigment cups extending into the 2nd annulus. They are large, simple, widely separated by about $1\frac{1}{2}$ times their diameter and directed forward and outward.

The gonopores are very obscure, concealed in the deep furrows resulting from the contraction of the annuli at that point. The δ appears to be at XII $a1/a2$, the φ at XII $a2/a3$, but better extended specimens or sections will be necessary to determine this definitely. There may be a common orifice. Anus a small pore notching somite XXVII from behind. Caudal sucker a relatively small but sharply defined and muscular circular disk directed ventrad and concealed beneath the body so that only a narrow crescent and about $\frac{1}{4}$ of the rim are visible from above.

Sensillae and nephropores cannot be detected in surface views. Cutaneous papillae are well developed on the dorsum of sensory annuli only. They form 5 series—median, outer paramedian and intermediate,—separated respectively by 6 and 5 longitudinal muscle bands, with 4 or 5 more between the intermediates and the margins of the body and 2 in each of the papillae lines, making 40 or 42 in all. The medians and paramedians begin (sufficiently large to be visible under a X10 lens) on VIII or IX and continue to XXV. The intermediate series is very incomplete, being represented by small and inconspicuous papillae on only a few somites in the posterior middle body region. Papillae are distinct low cones containing much black pigment, very prominent in the median and paramedian series on which they increase in size cephalocaudad until they occupy the full length of the annuli. The series are not strictly linear, as frequently papillae lie to one side or the other of the middle line and rarely a papilla will be biconical or divided into 2 smaller cones lying side by side. In addition to these papillae the dorsal integument is roughened by numerous Bayer's organs.

Unfortunately the color pattern is lost, the only pigment remaining being confined to the eyes and dorsal papillae.

Annulation: The annulation is well preserved. I and II are 1- and 2-annulate respectively, the separating furrow being shallow, and the broadly rounded anterior rim of the lip bears a crowded row of goblet cells and is separated from I by a shallow furrow. III 2-annulate, ($a1\ a2$) $> a3$ with a faint $a1/a2$ furrow. Eyes on the $a2$ component of the larger anterior annulus but the pigment cups reaching into $a3$. IV 2-annulate, with both $a1/a2$ and $a2/a3$ better developed than on III but becoming obsolete at the margins, where the somite merges with V to form the buccal ring. V 3-annulate dorsally, 2-annulate ventrally where ($a1\ a2$) forms the post-buccal ring, the total length of the annulus being slightly less than IV. VI, the first somite completely 3-annulate both dorsally and ventrally, $a1 < a2 < a3$. VII-XXIV 3-annulate; on pregenital somites $a2$ is generally more elevated and projects slightly above the general surface, especially at the margins, while caudad to the gonopores $a3$ is usually longer and faintly

2-annulate; on XXIV $a3$ is reduced, $a1 = a2 > a3$. XXV 2-annulate, $(a1 + a2) > a3$, $a1$ being incipient at the margins, completely merged with $a2$ in the middle. XXVI 2-annulate, with no trace of $a1$, and $a3$ very small. XXVII 1-annulate and partly including the anus. No papillae are visible on XXVI or XXVII.

Anatomy: Little of the internal anatomy can be made out from the contracted and rather opaque entire specimens cleared in glycerine. The proboscis is relatively short and stout, nearly cylindrical but slightly tapered to the free end, which bears a circle of 12 small rounded papillae. On the type it is protruded a distance of .8 mm. and has a maximum diameter of 1.6 mm. On the paratype the retracted proboscis reaches from the middle of somite VI to the anterior part of XII. Salivary glands extensively developed, forming a loose cluster extending along each side from somite IX to XVII, their ducts being aggregated into a pair of stout bundles which empty into the oesophagus in XIII. Gastric caeca 6 pairs arising in XIV to XIX, the first 5 being small and simple, slightly bulbous and bilobed at the ends, the 6th long, reflexed and reaching to XXV, with a short, rounded, lateral lobe in each somite from XX to XXIV. Intestinal caeca 4 pairs in XX to XXIII, short and simple. Reproductive organs are concealed largely by the opaque salivary glands and no definite characteristics were determined.

The paratype bears 2 egg capsules containing 4 and 6 embryos respectively.

The type specimens were collected by Dr. E. B. Worthington in weeds along the shore of Lake Bunyoni, Uganda, Station No. 707A (5), Aug. 13. Specimens occur also in the Omer-Cooper Abyssinian collection from the Wourambouchi River, Oct. 6 and Mt. Chilabu, Abyssinia, Nov. 8, 1926. Type in British Museum of Natural History.

Batracobdella tricarinata (Blanchard). Plate 26, fig. 19.

Hellobdella tricarinata Blanchard 1897b, p. 4.

Clepsine nilotica Johansson 1909, p. 152; 1913, p. 17.

Glossiphonia tricarinata et nilotica, Moore 1933, p. 299.

Hellobdella tricarinata, Autrum 1936, p. 18.

Batracobdella nilotica, Autrum 1936, p. 39.

Hemiclepsis tricarinata, Augener 1936, p. 391.

Johansson was impressed by the resemblance of his material to Blanchard's species, especially in the external characters of body form, expanded head, longitudinal papillated ridges and freely pedunculate caudal sucker. But he found many differences from Blanchard's description, notably in its having an additional pair of small eyes, 7 pairs of gastric caeca instead of 6 and in the normal position of the sex pores and sensillae instead of their being one annulus farther forward as stated by Blanchard. In all he lists no less than 11 characters in which his material differs from Blanchard's description. In my list of the leeches collected by Dr. Worthington in Kenya and Uganda (Moore 1933) I followed Johansson in separating the two species, though even then I realized that this was being done arbitrarily and with difficulty. Those specimens in which the pair of small eyes were

not detected and in which the papillae in the caudal half of the body were closely crowded to form ridges were placed in *G. tricarinata*; those in which the small eyes were obvious and the ridges less prominent in *G. nilotica*. In respect to the position of the sensillae and sex pores both lots agreed in being normal: both had 7 pairs of gastric caeca, the first 6 being bifid and lobed, instead of 6 pairs of simple caeca as figured by Blanchard, and in the organs of reproduction no essential differences were noticed. My notes continually emphasized resemblances between the two species as well as features in common with *Hemiclepsis*. A more recent reexamination of all available specimens showed that the anterior pair of small eyes can be seen in all but one, while 2 have a large eye present on one side only and another has the large eye on the left side replaced by 2 smaller eyes, one of which is directed caudad, the other cephalad, the corresponding eye of the right side being normal. The only respect in which my specimens differ from Johansson's is that the salivary glands, which are partly compact, partly diffuse, described by Johansson as reaching through somites VII to X (my IX to XII), in those studied by me extend from VIII or IX to XIII or XIV. Johansson saw only 3 or 4 pairs of testes, whereas all examined by me in dissections, whole mounts and sections showed the normal 6 pairs. My conclusion, therefore, is that the 2 supposed species are one. But I regret that Johansson's name must be abandoned as his description is by far the more complete and accurate.

Augener (1936) has anticipated this conclusion, stating definitely, in connection with his description of *Clepsinides windhukensis*, that the two species are synonymous and should be referred to *Hemiclepsis*. Augener studied one of Blanchard's specimens of *H. tricarinata* in the Hamburg Museum and found 2 pairs of eyes and 7 pairs of gastric caeca. On the other hand Autrum (1936), who examined Blanchard's type in the Berlin Museum, continues to separate the species both generically and specifically, but apparently he confined his attention to external characters. In one respect, however, namely, in demonstrating the presence of an additional pair (supramarginals) of papillated ridges, he corrects Blanchard and confirms Johansson.

Like Blanchard's and Johansson's specimens all of these are of small size, measuring from about 4. x 1.5 to 12.3 x 4 mm., indicating that they are broad, flat and contracted. All have the expanded head, the medium-sized, freely pedunculate caudal sucker and the papillated ridges of their descriptions. The mouth in all cases is clearly in the center of the oral sucker at the level of somite IV. The eyes are in III, the 1st pair very small and situated between the 2nd pair of large eyes, which are widely separated, frequently by as much as their own diameter or even more. Gonopores have the normal position for the family. The caudal sucker is relatively larger than shown by either Blanchard, Johansson or Autrum, but this is merely the result of difference of contraction due to the method of prepara-

tion. The color is entirely faded and no trace can be found of the 3 pairs of black spots described by Blanchard on the sensory annulus (a_2) of VII, VIII and IX (my notation). In the dorsal intermediate line of all somites from IX caudad on annulus a_3 is a pair of deep-seated yellow spots of reserve cells. If Blanchard mistook these for sensillae (see his figs.) then his annulation would agree exactly with my interpretation and the gonopores would be in the normal position as stated by Johansson. The arrangement of the papillae agrees with the descriptions of Johansson and Autrum and with Blanchard's figure so far as shown. They are of approximately equal size on the 3 annuli of a somite and between the 5 series of larger ones are about 4 or 5 times as many small ones. Under a lens the larger papillae may be traced as far forward as somites VII or VIII, but they are much larger caudally where they are elevated on more or less evident keels. The number of longitudinal muscle strands is about 43 dorsal and 43 ventral. With the exceptions already noted, the internal anatomy accords with Johansson's description. One specimen from Sta. 84 bears a fully formed spermatophore projecting from the δ pore. It resembles in size and form those of *Glossiphonia* and *Placobdella*. Another specimen from Sta. 127(8) evidently had recently borne young. The posterior venter is deeply hollowed and arched dorsad and the margins thin and produced into processes approximating those of *Podobdella* DeQual.

The following are all from Dr. Worthington's collections: No. 84 (1) under stones in surf at Buhuka, southeast shore of Lake Albert, Uganda, Apr. 16, 1928, 4, with *Salifa perspicax*; No. 123A (1), Kibaro, southwest shore Lake Albert, Uganda, Apr. 27, 1928, 13 (dried), several bear young within the produced and inrolled margins, with *S. perspicax* and *Placobdella auromaculata*; No. 141 (1), same, May 6, 1928, from *Bagrus docmac*, 35 m., 2; No. 114 (13), Lake Baringo, Kenya Colony, swamps on southwest shore, Jan. 26, 1931, 3; No. 115 (7), same, stony west shore, 2; No. 127 (8), same, shore of rocky island, with *S. perspicax*, 3; No. 520 (2), Lake Edward, Uganda, pool near north shore, 5; also British Museum of Natural History Coll., Somaliland, 2.

Batrachobdella quadrata new sp. Plate 26, fig. 20.

Measurements of type in mm.: Length 4.2, to δ pore 1.; widths, buccal .6, at δ 1.4, maximum (XIX) 2.6; depths not measured; sucker diameter .7 mm. The others are of nearly the same size and proportions, all being contracted, broad and flat. Unfortunately these specimens are very strongly contracted so that form and measurements are of little significance.

The general form is like that of a strongly contracted *G. complanata*, broadly ovate, widest caudad of middle, thence tapering rapidly to a blunt point at the lip; thick, strongly arched above, deeply concave below, with margins inturned. Head fairly distinct with a strongly thickened rim.

Mouth a very minute pore on a small isolated papilla rising from the middle of the cephalic sucker and well separated from the rim, apparently in somite IV. Eyes 2 pairs on III and IV, both large and approximately

equal, widely and equally separated on the two sides so that they form a square figure. Both pairs have deep and well-developed pigment cups, the first looking cephalad and laterad, the last directly caudad. Embedded in the pigment of the ventral side of the cups of the anterior pair of a specimen sectioned is a pair of minute accessory eyes, that of the left side being anterior, of the right posterior, but both complete, with shallow pigment cups and a few visual cells. No accessory eyes can be discerned in the other examples studied as whole mounts.

Gonopores in the usual position, the δ opening in the furrow XI/XII, the φ in XII $a1/a2$, both small. Neither sensillae nor nephropores were detected in surface views. There are no well-marked large papillae but about 30 small ones on the dorsum of each annulus of the middle body region and a slight median dorsal ridge which bears somewhat larger ones on $a2$ and $a3$. Similar ones are indicated in the intermediate series on both $a2$ and $a3$ as well as inner paramedians on $a2$ and outer paramedians on $a3$. Anus behind XXVII. The caudal sucker is very small and contracted, the prominent margins surrounding a small central opening as on the cephalic sucker.

No color; uniformly faded to a dull gray and no trace of pigment spots on the buccal ring or elsewhere.

Annulation: Annuli crowded and indistinct, especially at the ends. Annulation of I and II not determined; III 2-annulate, the 1st annulus larger and bearing the 1st pair of eyes; IV 3-annulate, but $a1$ and $a2$ more closely united and the 2nd pair of eyes on $a2$; V 3-annulate, $a1$ and $a2$ united on the venter to form the buccal ring. VI 3-annulate dorsally, 2-annulate ventrally; VII to XXIII completely 3-annulate, $a2$ being larger and more outstanding on middle body segments; XXIV 3-annulate but $a3$ reduced, $a2 > a1 > a3$. XXV 2-annulate, ($a1\ a2$) $> a3$ and XXVI similar but smaller. XXVII 1-annulate.

Anatomy: Gastric caeca 7 pairs, the 1st pair extending into XI and possibly X, anterior to the genital pores; the next 5 pairs are bifid with bulbous lobes and occupy somites XIV to XVIII inclusive; the last pair arises in XIX and reaches to XXIV, with lateral branches in each somite. The intestine bears the usual 4 pairs of short simple caeca.

The δ reproductive organs consist of a small bursa with a very short straight canal and much folded lining epithelium, with the thick-walled atrium or dorsal chamber projecting and opening into its cavity and receiving paired atrial horns on its cephalo-dorsal aspect. Atrial horns long and stout, directed almost horizontally laterad and strongly divergent. They have the typical structure and are filled with mature sperm. From a slight constriction due to a sphincter muscle at the apex of each horn, the ejaculatory ducts, which have thinner walls, continue in nearly the same direction laterad and bend ventrad to continue as the epididymes. These consist of a few loose folds of a thin-walled tube of uniform diameter confined to each side of somites XI and XII. The vasa deferentia were not traced and only the first 4 pairs of testes at XIII/XIV to XVI/XVII were actually demonstrated owing to the poor condition of somites XVIII to XX of the specimen sectioned. The φ organs consist of a short, vertical, common vaginal duct and a pair of spacious ovisacs which lie side by side in the ventral sinus between the 2 series of testes and reach to XIX.

This species differs clearly from *B. stuhlmanni* (Bl.) in numerous respects, notably in the position of the mouth, the very different arrangement and size of the eyes and the absence of the buccal pigment spots. It is, however, insufficiently known, as the material is scanty and poorly preserved.

Three specimens in the Omer-Cooper collection from Abyssinia, Addis Abbaba, Pond No. 1, British Legation, 1926, the type and one other on Sept. 10 and a third one on Sept. 8; also American Museum of Natural History, No. 4542 (Lang-Chapin) Kabare, Belgian Congo, Aug. 1914, pool in steppe. Type in British Museum of Natural History.

Placobdella (Parabdella) stuhlmanni (Blanchard). Plate 25, figs. 12, 16, 17.

Glossosiphonia stuhlmanni Blanchard 1897, p. 3.

Glossosiphonia garoui Harding 1932, p. 81.

G. stuhlmanni, Moore 1933, p. 299.

G. garoui et *stuhlmanni*, Autrum 1936, p. 9.

In view of the striking contrasts presented by the original descriptions the amalgamation of these two species may be as surprising to others as it was to the writer. The differences indicated by the authors include such important features as the position of the mouth and gonopores, the number and location of the eyes, and the color pattern. Almost the only important diagnostic character that they have in common is the pair of conspicuous black marginal crescents on the buccal ring. Blanchard indicates 2 pairs of eyes on I and IV, separated by 2 somites of 1 annulus each, the gonopores between the 2nd and 3rd annuli of X and the 1st and 2nd annuli of XI respectively, and the mouth in the center of the cephalic sucker. Harding describes 3 pairs of eyes on II, III and IV, the gonopores at XI *a1/a2* and XI/XII and the position of the mouth as doubtful. My observations agree with Harding with respect to the eyes, with Blanchard in the position of the gonopores (which are at XI/XII and XII *a2/a3* when his system of notation of somites and annuli is reduced to that followed by Harding and myself) and place the mouth at the anterior rim of the sucker. The discrepancies in color have little significance as the colors of leeches are peculiarly subject to alteration and loss in preservation.

On the preliminary sorting of the material after only casual examination some specimens were assigned to *stuhlmanni*, others to *garoui*, among the latter being some from exactly the same locality and lot as Harding's type, so that they are topotypes. Although in a poor state of preservation they agree fully with Harding's description except in the position of the gonopores, which were found to be 2 annuli farther caudad than he states. Those referred to *stuhlmanni* are specimens which exhibit 1 pair of large conspicuous eyes and caudad of these a pair of small and inconspicuous eyes as figured by Blanchard, but apparently no eyes anterior to the large pair. Most of these also have the buccal pigment spots distinct and show little or none of the *complanata*-like dorsal pattern of *G. garoui*. When these

specimens were cleared and studied in good light the anterior pair of eyes on II was invariably disclosed. It seems clear, therefore, that Blanchard overlooked this inconspicuous pair of eyes and included the reduced somite II in his small preocular lobe. The eyes of the 3rd pair are smaller and deeper below the surface than the large ones and obscured in a diffuse spot of pigment that is usually continuous across the middle line and spreads for some distance laterad over annulus IV *a2*.

In correspondence with Mr. Harding it was learned that *G. garoui* was based actually on the examination of a single very poorly preserved specimen, that reference to *G. stuhlmanni* was considered and rejected on account of the apparently marked divergencies and that an attempt to compare his type with Blanchard's failed because Prof. Brumpt wrote that he knew nothing of the specimens. This is unfortunate as questions of synonymy can seldom be regarded as finally settled until types have been critically compared. The position of the gonopores determined by Harding is yet unexplained, as all specimens examined by me had them in the normal situation. The possibilities are individual variation or error of observation owing to the poor preservation of the material. If Harding overlooked the ♀ pore, mistook a depression in the furrow XI *a1/a2* for the ♂ pore and the true ♂ pore for the female, the discrepancy would be explained. On strongly contracted leeches the small ♀ orifice is often very difficult to see. Cases like this illustrate the importance of care in the preservation of collections, particularly of soft-bodied animals like leeches. The difficulties of systematic students are enormously increased by the frequent necessity of working with poorly preserved material and much confusion has resulted therefrom. Under date of January 24, 1933, Mr. Harding writes further: "The idea that *G. garoui* and *G. stuhlmanni* are founded upon the same species, now that you have explained how Blanchard missed somite II and the first pair of eyes, is most attractive. An important feature common to both leeches seems to me to be the black markings at the edges of the ring forming the base of the anterior sucker."

The eyes of the 1st pair are variable in their distance from the 2nd pair and from each other, being in some cases united in a common pigment mass, in others well separated. Those of the 3rd pair are shallow cups which vary in size and in the number of visual cells which is always small. In one series of sections none whatever can be detected. Blanchard suggests that the black or chocolate-colored spots on the buccal ring may be formed of several coalesced eyes. Support is given to this view by the presence in a series of sections, within the pigment mass, of a few visual cells, but the material is too ill-preserved for detailed histological study.

In the matter of annulation my results agree exactly with Harding's except that the furrow on somite II is so shallow that it scarcely can be considered to be 2-annulate. This somite is also very short and not strongly separated from I. VI is very short and forms the nuchal constriction.

Intersegmental furrows are generally deeper than the interannular and on the venter of the middle body region strongly emphasize the metamerism; *a3* is longer than the other annuli and secondarily faintly 2-annulate on both venter and dorsum, whereas other annuli are subdivided only dorsally, if at all. The segmental papillae bearing the sensillae are low, rounded domes, on some specimens almost flush with the surface, on others fairly elevated. In addition to the dorsal outer paramedians and the intermediates figured by Harding, the latter of which are the largest, there are paired supramarginal series and 2 pairs of ventral series. Besides the segmental papillae there are from 20 to 30 small conical papillae in a regular transverse row on the dorsum and as many on the venter of each annulus of complete somites. The glands of the caudal sucker are unusually numerous and conspicuous.

The most constant features of the color pattern are the deep brown or black buccal crescents which are widest at the extreme margins and taper to a point both above and below so that from either dorsal or ventral views they appear to be triangular, and the dorsal paramedian longitudinal brown stripes, which usually consist of a series of short dashes on *a1* or sometimes extending onto the contiguous annuli but never onto the segmental papillae, which are pale yellow or whitish. Other individuals may have in addition any or all of the following longitudinal stripes which are double lines: median, intermediate, supramarginal and marginal. The last 3 include the corresponding sensillae. The venter may be plain yellowish or gray, or in one lot thickly speckled with brown, possibly due to accidental staining.

The stout pharynx receives the ducts of a pair of compact salivary glands at its caudal end in somite XI. Gastric caeca are 7 pairs, the 1st arising in XIII, small and prolonged forward into XII, the next 5 confined to their somites and trilobed distally, the last arising in XIX, reflexed, and reaching to XXV. The atrium is small and its cornu long and conical but otherwise presents no unusual characters. Besides the loosely folded epididymis and ejaculatory duct in XI and XII, the sperm duct forms a long posterior loop or spermatoc vesicle of enlarged diameter which may reach as far as somite XVI as in one dissection. Testes 6 pairs. In the most mature individual dissected the ovisacs reach to XVII, lying in the ventral sinus more or less enwrapped by the spermatoc duct loop.

This species is evidently abundant in Kenya and Abyssinia as shown by the following list of collections: Christy Tanganyika Exp. Off Crescent Il., Lake Naivasha, Kenya Colony, July 2, 1929, P. M. Jenkins No. A222, shallow water, rocky shore, 3; same, July 7, Jenkins VIII No. F246, among Potamogeton, 5; same, Mkelia River, May 16, 1929; same, Christy Coll. No. A75, under stones in pool, 3; Worthington 1931 Coll., No. 27 (2), Lake Naivasha, Kenya Colony, from weeds along east shore with *L. oligodonta*, 3; Omer-Cooper Abyssinian Coll. 1926, Serpent Lake, Wourambouchi, Abyssinia, Sept. 2, 6; same, Oct. 3, 1; same, Oct. 5, 7; same, stream below lake, Oct. 6, 2; same, marshes above lake, Oct. 7, 1; same, Mt. Chilalu, Abyssinia, Nov. 8, with *G. conifera*, 2; same, no locality, 1; Lake Manshya, Northern Rhodesia, Miss Ricardo No. 15/1, with *L. fenestrata*, 1; same,

effluent river, 42/5, 1 with *L. fenestrata*; Naukluft Mts. above Bullsport, South West Africa, 1500 m., K. Jordan, Dec. 5, 1932, 3 with *L. obscura*.

The generic reference of this species is as troublesome as its specific determination. In the position of the mouth, the character of the salivary glands and the arrangement of the 7 pairs (Harding says 6) of gastric caeca it is typical placobdellan. The 3 separate pairs of eyes unite it with *P. ceylanica* Harding in Autrum's new subgenus *Parabdella*, while the long posterior loop of the sperm duct brings it closer to *Glossiphonia*. Superficially, and especially as originally described as *G. garoui*, it resembles *G. complanata* and might be thought to be closely related to it, but a closer study discloses many divergent characters, the most important being that the latter has 10 pairs of testes and the mouth central, whereas the former has 6 pairs of testes and the mouth subterminal.

Placobdella (Parabdella) aspera, new sp. Plate 25, figs. 5, 6, 7.

Form ovate in contraction, the state of most of these examples, becoming lanceolate in extension, the outline in general like that of *P. catenigera*. Type measures in mm.: Length 14.9, to δ pore 3.2; widths, buccal 2.1, δ 4.8, maximum (XX) 6.3, anus ca. 2.5; depths ca. 1.2, 1., 1.5, .5; sucker diameter 3.5. Other specimens vary from 9. x 3. to 24. x 9. mm. With the exception of the type and one or two of the smaller ones all are rolled into a ball with the head inside, moderately to strongly depressed, with the maximum width from 2 to 4 times the corresponding depth, becoming less so anteriorly to the buccal ring; dorsum strongly arched, venter nearly flat, margins sharp. Head not perceptibly widened, continuing the general outline of the body, no nuchal constriction but a deeper furrow following somite VI. Oral sucker with a deep ventral cavity and well developed rim, the apex of which is perforated by the small mouth pore. On the type and one other the slender proboscis projects from the mouth for a short distance. Lip prominent, with a median emargination and short furrow. Eyes 2 pairs but appearing superficially as one pair of large ones, separated by a distinct but narrow median interval, but occasionally as a median pigment spot. Second pair of eyes well developed, large with usually distinct but approximated pigment cups directed cephalo-laterad on III *a2*. First pair, probably representing the paramedian sensillae of II, about $\frac{1}{4}$ to $\frac{1}{3}$ the diameter of the large eyes, with shallow pigment cups looking directly cephalad, always definitely anterior to the 2nd pair but in some cases appearing to be in contact with their pigment cups, widely separated medially so that they lie nearly opposite to the outer margins of the large eyes. Genopores as usual, the δ XI/XII, η XII *a2/a3*, both strictly in the furrows and fairly large. Nephropores were doubtfully seen in surface views but were definitely demonstrated in the usual position in sections. Anus behind XXVII followed by 1 or 2 partial annuli. Caudal sucker large, usually exceeding $\frac{1}{2}$ the maximum width even in contracted specimens, expansive, with thin margin and deeply cupped venter. Circular and radial musculature shows very clearly. The former consists of about 14 rings. The latter consists of 3 superimposed sets, beginning at the center as 14 muscular rays which branch like flat brushes toward the margins; then

halfway toward the periphery, and alternating with the former, begins a set of 14 similar rays which likewise terminate at the margins in 8 or 9 muscle fibrils, making a total of from 224 to 252 radial fibers at the margin. A third, less regular, radial set is ventrally superficial to these. On the body are 21 longitudinal muscle bands on dorsum and the same on venter on each side of the meson.

Color: Practically all faded to a uniform yellowish ash or on some specimens a light brown but differing in tint on different specimens. On the dorsum are traces of darker brown markings, most frequently a median and occasionally a pair of intermediate broken stripes along the corresponding papillae, and less often irregular brown blotches alternating with pale transverse bands, and a median pale stripe at the anterior end; caudal sucker with 3 pairs of brown rays. On cleared specimens a brown pigment mass on the posterior part of the head.

Annulation: I a very short annulus with anterior median cleft, united with II and forming with the prostomium the lip or apical lobe; II a short annulus faintly separated from I but by a distinct furrow from III and possibly with a faint $a2/a3$ furrow. Small eyes probably the paramedian sensillae of II but at its caudal margin. III 2-annulate ($a1 + a2 > a3$, with trace of $a1/a2$, $a2/a3$ well defined and III/IV deeper; eyes on III $a2$. IV 2-annulate, like III but larger and better developed; $a3$ uniting with V to form buccal ring. V 3-annulate dorsally ($a2 > a1 > a3$), 2-annulate ventrally ($a1 \approx a2$) forming with IV $a3$ the buccal ring, $a3$ small and in the nuchal furrow. VI and VII 3-annulate with $a1$ and $a2$ more closely united, especially on venter. VIII-XXIII 3-annulate, $a2 < a1 < a3$, with $a3$ somewhat longer and more prominent owing to the large papillae. XXIV 3-annulate with both $a1$ and $a2$ much reduced. XXV 2-annulate, ($a1 \approx a2$) much $> a3$. XXVI 1-annulate with traces of $a3$ separated at the margins. XXVII 1-annulate.

Sensillae are distinctly visible on the dorsum, especially of the posterior half where they are disposed as in *P. rugosa* (Verr.) and similar species but they were not seen on the venter. Papillae numerous and conspicuous over entire dorsum but especially so caudally where they become large and many of them wart-like. Median series continuous for entire length, posteriorly becoming very prominent and elevated on a ridge reaching to XXV. It is formed of large conical rough papillae on $a2$ and $a3$ and by much smaller ones or none on $a1$. The others are distributed much more irregularly and do not form definite series. On $a1$ there are from 13 to 17 small, usually simply conical papillae of approximately equal size, the median one being frequently absent but in some cases somewhat enlarged. $A2$ usually bears 7 large ones, each with a rosette of pointed Bayer's organs at the summit; the largest are usually the outer paramedians and intermediates with the median and supramarginals somewhat smaller, though on some individuals the median is the largest of all. Between the large papillae, and forming with them a transverse row, are 5 to 7 small, simple ones on each side. On $a3$ the median papilla is the largest and very strikingly so on posterior somites and there are much smaller inner paramedians, inner intermediates and inner supramarginals, which are staggered with the corresponding papillae on $a2$. Between the large papillae are a few small ones. The median series ends very abruptly on XXV $a3$, the papillae on XXVI and

XXVII being very small. On each side of the dorsal face of the caudal sucker are 6 irregular radial lines of 5 to 7 small papillae.

Anatomy: The slender proboscis, when retracted by the pair of retractor muscles, assumes the form of a circular loop in IX and X. Salivary glands 2 pairs, compact, the 1st in IX, extending into VIII and the 2nd in X extending into XI. The duct bundle of the 1st arises from the anterior end and runs caudad on the medial side of the gland and that of the 2nd at the middle of the gland and runs transversely. Both open into the caudal end of the pharynx in XI, either separately or after uniting into a short common duct bundle. Gastric caeca 7 pairs, arising in XIII to XIX, the first 6 divided into 2 branches with expanded lobate ends; the 1st with its anterior branch prolonged into XII and a short distance in XI; the next 5 confined to their somites, with the anterior branch longer and more lobed; and the last reflexed by the sides of the intestine to XXIV with a pair of lateral branches resembling the anterior caeca in each somite. Intestine with 4 pairs of rather long simple caeca dorsal to the last. Reproductive organs of the Placobdellian type except that the spermduct is provided with a long loop, consisting of an enlarged spermatie vesicle reaching to about XVI and the returning vas deferens, which accompanies and is more or less wound round the ovisacs in the ventral sinus. The atrium is small and pyriform, the cornua short and globoid and the epididymi with a short preatrial limb and a few coils laterad of the atrium from which the loop referred to above arises. Ovisacs are united in a short, common, oviduct or vagina opening at the ♀ pore and consist of paired slender tubes containing both maturing ova and sperm more or less folded and twisted round each other and the spermatie vesicles within the ventral sinus to XIV or XVI in different specimens dissected.

Type in the American Museum of Natural History.

This species also may be referred to subgenus *Parabdella*.

Thirty specimens rolled tightly into balls but otherwise well preserved were taken by the American Museum Lang-Chapin Congo Exp., No. 100, Medje, Belgian Congo, May 7, 1910, from a crocodile No. 475. Two of the smaller specimens bear a few stalked ciliates like *P. jaegerskioeldi*.

From *P. stuhlmanni* this species is distinguished especially by the absence of the 3rd pair of eyes on IV, by the absence of the black crescents on the buccal ring and by having 2 pairs of salivary glands instead of one; it resembles that species in many respects, notably in having the long, *Glossiphonia*-like posterior loops to the sperm vesicles.

***Placobdella multistriata* (Johansson).** Plate 26, fig. 22.

Clepsine multistriata Johansson, 1909, p. 151; 1913, p. 14.

Placobdella aegyptiaca Harding, 1911, p. 388.

Haementeria multistriata, Augener 1936, p. 392.

Haementeria (Placobdella) multistriata, Autrum 1936, p. 72.

H. (P.) aegyptiaca, Autrum 1936, p. 73.

This species was founded upon a single example only 6 mm. long taken in the White Nile at Gebel Ahmed Aga. Harding's type and largest specimen (14.5 x 5. mm.) was taken from *Trionyx triunguis* at Cairo. Making

allowance for the difference in method of enumerating somites, the two descriptions agree practically completely so far as they deal with the same characters and in other respects supplement each other. Johansson deals more with internal anatomy and Harding with the annulation. The principal distinction is in the color pattern which in preserved leeches is usually unreliable. My best preserved and most thoroughly studied material consists of one example 28. x 9.2 x 2.5 mm., caudal sucker 3.7 mm. and 3 measuring 7.5 x 3.3 to 9. x 1.4 mm. with the caudal sucker relatively larger. One of the smaller specimens was studied as sections and all of the others entire, both as opaque and transparent objects. In addition are 7 others from the Congo and 8 from Liberia which agree in all essentials.

The annulation agrees with Harding's account except that XXIV is 3- rather than 2-annulate, the furrow $a1/a2$ being complete, although shallow, especially in the median field. In the cephalic region I and II are scarcely separable by a very faint furrow; III and IV are 2-annulate, V 3-annulate dorsally and forming most of the buccal ring ventrally, and VI is 3-annulate dorsally and 2-annulate ventrally in the median field. Large papillae are entirely absent but minute ones, probably a single Bayer's organ only, are very numerous and scattered nearly uniformly over the dorsal surface, approximately 100 occurring in a double transverse row on each annulus of the largest specimen. On small specimens they are evident only in the supramarginal and intermediate fields of posterior annuli.

The rather large and distinct eyes are close together on somite III, simple, with deep, sharply defined pigment cups and no trace of accessory eyes. The salivary glands are 2 pairs, very compact and occupy, one, somites, VIII and IX the other X and XI, agreeing with Johansson who places them in his VI-VIII. Gastric caeca are 7 pairs, as stated by both Johansson and Harding. Reproductive organs are of large size even in the small specimen sectioned and are of the typical *Placobdella* form, the spermducts being compactly folded and lacking a long posterior loop, the sperm vesicle reaching to the end of XIV only, and the 6 pairs of testes at XIII/XIV to XVIII/XIX. The ovisacs are short and crowded but this is due in part to the contracted state of the specimens. One specimen bears a discharged spermatophore, about 1.5 mm. long and $\frac{1}{2}$ as thick, attached to the ventral surface at XX $a2/a3$. The specimen sectioned contains a compact globular mass of sperm in XXI but bears no spermatophore.

The color is much faded but there are faint traces, most distinct on the largest specimen, of the longitudinal stripes arranged as described by Johansson.

The 4 lots of specimens were taken at Faradje, Belgian Congo, in Jan. 1913, by the Lang-Chapin Exp., No. 551, with *L. oligodonta*; same, No. 550, 7; Bequeart Coll. Du River, Liberia, Aug. 9, 1926, from back of *Crocodylus cataphractus*, 4; same, Pehata (or Paiata), St. Paul's River, Liberia, Oct. 11, 1926, skin of crocodile (*Osteolaemus tetraspis*), 4.

This species appears to have its closest affinities with the next but differs in having 2 pairs of salivary glands and in lacking the cutaneous papillae

which are well developed in *P. jaegerskioeldi*. Augener appears to consider it to be the same as *Glossiphonia algira* Moq.-Tandon. He had 30 examples from South West Africa and gives a full description of the color pattern. Five longitudinal rows of large warts, together with some smaller ones, are described, which seems to fit *P. aspera* better than *P. multistriata*.

Placobdella jaegerskioeldi (Johansson). Plate 25, figs. 3, 4.

Clepsine jaegerskioeldi Johansson 1909, p. 146; 1913, p. 3.

Placobdella jaegerskioeldi Pinto 1923, p. 129.

P. jaegerskioeldi, Moore 1933, p. 299.

Haementeria (*P.*) *jaegerskioeldi* Autrum 1936, p. 75.

This appears to be a common species. The general characteristics (form, annulation, etc.) are close to *P. parasitica* but the rough papillation is more like *P. rugosa*, though differing from the latter in arrangement. The papillae are roughened with prominent Bayer's organs but except that in some specimens they are alternately larger and smaller they differ little in size or prominence. In the middle region every annulus bears dorsally from 13 to 15 or, including smaller ones, up to twice that many, in a transverse row, but on successive annuli there is little tendency to form regular longitudinal series. On complete somites the first annulus is the shortest on the venter but is distinctly subdivided into two. Mouth minute, at extreme tip of oral sucker; eyes one pair on III, with pigment cups united or separated but always close together and without accessory eyes; caudal sucker large, especially in the young, as usual in parasitic forms. When best preserved the color pattern shows 5 pairs of dark brown longitudinal stripes and on some specimens a median stripe, all best defined at the anterior end. Salivary glands one pair, very large, extending from somites VIII to XII, with the single stout bundle of ducts arising from the medial face of the anterior end and running side by side with the other one of the pair on the dorsum of the pharynx to its caudal end in XI or XII. Sperm duct without long posterior loop, the enlarged sperm vesicle reaching to XIV only.

Most of the specimens taken from hippopotami bear large numbers of a stalked ciliate infusorian of the type of *Epistylis*. These increase in number with the size of the leech and are largely aggregated in tufts along the margins of the anterior middle body, though found on all parts. They give to the leech a fringed appearance, superficially like *Ozobranchus*, the gills of which they remotely resemble.

The following lots were studied: Worthington Coll., No. 520 (2), Lake Edward, Uganda, pools near north shore, June 8, 1931, 1 with *B. tricarinata* and *S. perspicax*; same, No. 609, east shore of Lake George, Uganda, July 24, 1931, 14 from tail of *Hippopotamus*; same, Sta. 5 No. 6, Butiaba, Lake Albert, Uganda, Mar. 24, 1928, 6 from *Trionix* sp.; G. M. Graham, Sta. 41, Lake Victoria, Bumbirch Id., along shore, 1; Lang-Chapin, No. 550, Faradje, Belgian Congo, Jan. 1912, 1 bearing young and a spermatophore on the

posterior dorsum; same, Avakubi, Belgian Congo, Dec. 10, 1913, many from *Hippopotamus*; L. Gidalet, École d. Méd. Vét. Brussels, Congo, Apr. 1915, from *Hippopotamus*, 20, several bearing spermatophores, no attached ciliates which may have been lost through drying; same, "Tortue les Asuit, 1915", 3 fully engorged which have been dried so that the determination is questionable; Kampala, Uganda, Bequaert, Apr. 17, 1927, from *Hippopotamus*, 1; Entebbe, Uganda, Sept. 1933, pharynx of *Hippopotamus*, Fazal Din Ahmedi, Coll. No. 424, received through R. W. M. Mettan of Veterinary Service, 10; Lake Victoria, alt. 3726 ft. July 15, 1934, "small intestine of *Hippopotamus*", Dir. Uganda Veterinary Service, many very small but typical specimens; Kafue River, Northern Rhodesia, 1928, Silvester Evans, 12 from lips and tongue of *Hippopotamus*.

Placobdella pulchra, new sp. Plate 25, figs. 8, 9.

The type measures in mm.: Length 27.5, to δ pore 7.; widths, buccal 1.8, at δ pore 4.6, maximum (at XIX) 7.8, at anus 2.5; depths, buccal 1.2, δ pore 2.8, XIX 2.8, anus ca. 2, sucker 3.5. The paratype is 25.2 x 6.2 mm. with the caudal sucker 2.9 mm.

The moderately extended specimens have a slender lanceolate-ovate outline with the head fairly well marked off by a slight nuchal constriction; only moderately depressed, with flat venter, slightly arched dorsum and medium sharp margins. Head slightly expanded beyond a shallow nuchal constriction. Mouth a minute pore at extreme anterior tip of sucker rim in somite I. Eyes one pair close together or united in a common pigment mass on somite III but owing to the shortness of I and II very far forward close to apex of the head. They are dark brown, large and conspicuous in a colorless area. A careful study of cleared specimens reveals no accessory eyes and as the material is favorable they are probably absent, though this conclusion should be verified on sections. Gonopores normal in position, the δ at XI/XII, a conspicuous round orifice, the φ a very minute but evident one at XII $a2/a3$. Nephropores in the usual position on the cephalic margin of $a2$ from VIII to XXIV inclusive, except in genital region. Anus behind XXVII, cutting into its caudal half. Caudal sucker of moderate size, largely exposed, with well differentiated peduncle, flat, discoid. Papillae are all very small and clearly visible only in the caudal half. Each annulus bears on the dorsum a transverse row of 19-23, all of the same size and form. Sensillae have the arrangement so well known in *P. parasitica* and are conspicuous on the head segments and less so, but quite evident, throughout the body. They are slightly elevated and are easily distinguished from the papillae as colorless dots in small brownish yellow spots.

Color: Largely destroyed by preservatives, bleached to a general diffuse translucent yellowish constituted of 38 dark intermuscular and as many pale muscular, fine, longitudinal lines of brown chromatophores with small irregular spots of yellow reserve cells about the dorsal sensillae. The internal organs, which show through the translucent integuments, have the following colors: Spermatophore sacs (atrial horns) opaque brown, testes translucent pale brownish, remainder of reproductive organs of a faint

yellowish tint, central capsules of nephridia opaque yellowish, tubules colorless, pharynx and stomach transparent colorless, intestine and caeca with a little brown contents and salivary glands very pale opaque cream color.

Annulation: Of the *Placobdella* type. I and II are 2 very short, closely united annuli bearing paramedian sensillae; III 2-annulate with very shallow $a2/a3$ furrow and larger anterior annulus bearing the large paramedian eyes and intermediate sensillae; IV 2-annulate like III but larger with faint $a1/a2$ and well-marked $a2/a3$ furrow, and paramedian, intermediate and supramarginal sensillae on $a2$; V 3-annulate ($a1 < a2 < a3$) dorsally, $a1/a2$ much $< a2/a3$, all dorsal sensillae on $a2$; ventrally $a1$ and $a2$ annuli united in buccal ring, with $a3$ only faintly distinct; VI 3-annulate ($a1 < a2 < a3$) dorsally with $a1/a2$ slightly $< a2/a3$, 3-annulate ($a1 = a2 > a3$) ventrally and bearing the full set of both ventral and dorsal sensillae; VII to XXII complete and fully 3-annulate, $a1 = a2 < a3$. On all of these somites $a1$ and $a2$ are equal and $a3$ is slightly longer on the dorsal side at least. The first furrow ($a1/a2$) becomes gradually deeper but remains throughout perceptibly shallower than $a2/a3$, so that the underlying 2-annulate condition may be detected even in the posterior middle region. XXIII 3-annulate ($a1 = a2 = a3$) on dorsum, while ventrally the annuli become crowded and the furrow $a1/a2$ shallow; XXIV 3-annulate ($a1 =$ or $> a2 > a3$) dorsally, $a3$ much reduced, ventrally all annuli crowded and entering into the base of the sucker peduncle; XXV 3-annulate, ($a1 = a2 > a3$); XXVI similar but smaller; XXVII 1-annulate.

Anatomy: A few notes on the internal anatomy are gathered from a single cleared example. The very slender retracted pharynx reaches from ganglion VIII to the caudal end of X in which somite it forms a loop and passes into the oesophagus in XI, where there is a second loop just anterior to the atrium. Salivary glands are 3 pairs of solid masses of secreting cells opening by separate bundles of ducts into the caudal end of the proboscis in the anterior part of XI. The largest is the 2nd pair, mostly in X but extending into XI. The most anterior in IX are somewhat smaller and those of the 3rd pair, chiefly in XI but reaching in XII close to the oesophagus, are much smaller. The crop-stomach bears 7 pairs of gastric caeca, the 1st of which, arising in XIII and extending into XII, are trilobate and small. Those of the next 5 pairs (XIV-XVIII) are broad, spacious and simple or slightly bilobed at the distal end. The last pair, arising in XIX, reach by the sides of the intestine into XXIII, with lobes similar to the preceding caeca in each of the 5 somites occupied. Intestine slender, with 4 pairs of simple thin-walled spacious caeca, the first 2 directed obliquely forward in XX and XXI, the 3rd oblique and caudad in XXII and the last much more caudad in XXIII and XXIV. δ reproductive organs have the bursa and atrial chamber small, the atrial horns short, thick and globoid, the ducti ejaculatorii and epididymes forming a few open folds laterad of the atrium and extending caudad into XII as a pair of wide loops or sperm vesicles into which the narrow vasa deferentia open. Testes 6 pairs at XIII/XIV to XVIII/XIX. ♀ organs a short vertical duct or vagina running from the gonopore to a small chamber beneath the nerve cord from which the 2 ovisacs extend side by side within the ventral sinus to XIV or beyond. The sacs contain both ova and sperm but the exact distribution was not determined.

A large number collected by Miss Ricardo supply some additional data. The size ranges from 4. x 1.2 to 15.3 x 3. mm., other measurements of one of the latter being: to δ pore 4.7; widths 1.3, 2.3, 3. and 1.4 and depths at same points .8, 1.4, 1.8, 1.4, sucker 2. mm. Due to a different method of preparation they are relatively less depressed than the types, with the head more rounded and the caudal sucker less contracted. Color faded to dull yellowish below and in the median field above, the dorsum elsewhere tinted brown by numerous minute chromatophores largely disposed in longitudinal intermuscular lines. Besides these are more or less distinct, broken, longitudinal stripes in the median, paramedian, intermediate and supramarginal lines. The small dark brown spot on IV and the yellow subsensillar spots are very constant.

The δ pore is often surrounded by a very slightly elevated elliptical area. The caudal sucker is relatively to the body width much larger than in the types and bears a circle of sensillae within small brown spots, giving an appearance of ocelli. The annulation, which is excellently preserved, agrees in all essentials with the above description but some variations were observed. V may be $a1 = a2 < a3$ and VI $a1 = a2 = a3$ dorsally. On complete somites $a1$ and $a3$ may be faintly subdivided on the venter but not on the dorsum. Intermetameric are deeper than intrametameric furrows. XXVI is usually 2-annulate at the margins only.

Dissections and additional whole mounts confirm the observations on internal anatomy. The conspicuous looping of the caudal end of the retracted proboscis is constant but usually there is only one large coil of a complete circle or more extending through X and XI. In all examined there were found 3 pairs of salivary glands conforming to the earlier description except they may occupy the somites from VIII to XII. The δ atrium is small and globoid, the cornua similarly shaped with a marked constriction at the entrance of the ejaculatory duct and the epididymis and sperm vesicles a few close folds confined to XI, except for a little of the latter extending in XII. Ovisacs may reach to XVIII and are usually asymmetrical, one being 1 or 2 somites shorter than the other.

Two well-preserved specimens from the Christy Tanganyika Coll., No. 441, attached to weeds in a water-blocked river mouth, affluent of Lake Tanganyika, Oct. 23, 1926. The slightly smaller paratype bears about 20 young 2.5 mm. long. Also collection of Miss C. K. Ricardo, No. 42/5, Mansya River, outlet of Lake Young, Northern Rhodesia, Aug. 22, 1936, 1 with *Limnatis*; same, No. 49, Aug. 31, 29 from neck of tortoise, color whitish. Type in British Museum of Natural History.

Placobdella auroguttata, new sp. Plate 26, fig. 21.

The type and only specimen measures in mm.: Length 13, length to δ pore 2.6; widths, buccal 1.6, at δ pore 3.8, maximum (XXI) 7; depths, buccal .8, δ pore 1.3, XXI 2.7, anus ca. 1.; contracted caudal sucker 2 x 1.6.

General form broadly ovate-euneate, moderately depressed with flat venter and convex dorsum; no nuchal constriction but head region continuing general outline; caudal margin almost straight or slightly concave transversely from somite XXIII; lateral margins from XXIII to XVI broadly convex with little reduction in width, beyond which they are nearly straight and convergent to the broadly rounded lip, which is inrolled ventrally to make the anterior outline truncate. This outline with the truncate ends is due to strong contraction on the blood-filled stomach, the leech having the aspect of being very plastic and extensile in life. Margins slightly scalloped due to intersegmental constrictions. No distinct cephalic expansion, the lip contracted and inrolled. Mouth not distinctly seen but probably at apex of lip where there is a small median depression, and no opening can be seen elsewhere on the ventral face of the cephalic sucker. Eyes one pair, very distinct in a yellow area on III, with small, dark brown, sharply defined pigment cups facing forward and upward and separated by a distance equal to their diameter. They appear to be simple but in the absence of sections or suitable material for whole mounts it cannot be stated positively that there are no small accessory eyes as in typical *Placobdella*. It is certain, however, that there are no separate, pigmented eyes on contiguous somites. Although small, the gonopores, and especially the δ , are sufficiently distinct as small pores at XI/XII (or slightly within XII *a1*) and XII *a2/a3* respectively. Nephropores open in the usual position on the cephalic margin of *a2* of middle body somites, the 1st on VIII and IX being very distinct, others less so. Anus behind XXVII. Dorsal papillae are very low, small, smooth and rounded, like those of the smooth form of *P. parasitica*, and are arranged in the same way, the larger ones in a median and 4 pairs of series. Sensillae also are arranged as in *P. parasitica* and are very distinct as minute translucent dots which appear dark in the centers of yellow spots on the neural annuli.

Color: The color pattern resembles that of certain species of *Theromyzon* (*Protolepsis*). Ground color olive green, generally uniform above and below but darker and greener in the central area corresponding to the blood-filled caecal region and paler and more yellowish or brownish at the anterior (pregenital) end, margins and the caudal sucker. Venter immaculate. Dorsum thickly speckled with small, irregularly rounded, golden yellow spots, the largest of which have a diameter slightly less than the length of the annuli and the smallest are mere dots. The largest are metameric in arrangement, in part corresponding with and including the sensillae on *a2* and in part forming a median series on *a3*, and also a pair of marginal series of blotches spreading over *a3* and the following *a1*, 11 series in all. The largest of all are the intermediates on *a2* which are followed by smaller intermediates on *a3*. Besides these there are smaller spots and a great many specks scattered irregularly but fairly uniformly on all annuli over the entire dorsum, somewhat more numerous at the ends. Dorsum of caudal sucker with 7 radiating series of spots on the exposed

sector and 3 more pairs, much more irregular, on the concealed anterior sector.

Annulation: Except at the anterior end, where the lip is turned ventrad and the furrows obscure, the annulation is clearly defined. I and II appear to be united in a rather long, pre-ocular annulus; III obscurely 2-annulate, the eyes on the larger anterior annulus; IV 2-annulate, $(a1 + a2) > a3$, the latter entering the lateral margin of the sucker rim; V 3-annulate, $a1 < a3 < a2$, but $a1$ and $a2$ more closely united, ventrally all unite to form the buccal ring; VI similar to V but $a1$ more distinct dorsally; ventrally $a1$ and $a2$ united to form a postbuccal ring, $a3$ remaining distinct; VII 3-annulate dorsally, 2-annulate ventrally, similar to VI but larger and more developed; VIII to XXIII completely 3-annulate; on pregenital somites to XII (probably emphasized by contraction) $a1/a2$ is so shallow and the annuli so crowded that the somites appear almost 2-annulate; behind this they are less crowded but $a1/a2$ remains $< a2/a3$ and generally $a1 < a2 < a3$ on the dorsum and $a1 < a3 < a2$ on the venter, with the intersegmental furrows deeper than the others all round; XXIV 3-annulate but $a1$ and $a2$ much more closely united and $a3$ reduced in length; XXV and XXVI 2-annulate, $(a1 + a2) > a3$ but the latter much smaller and the furrow $a2/a3$ obsolete medially; XXVII obscurely 2-annulate at the margins and the anus cutting into it posteriorly.

Type only in British Museum of Natural History, E. B. Worthington Sta. 123A No. 1, Kibero, S. E. shore, Lake Albert, Uganda, Apr. 27, 1928. One specimen with *B. tricarinata* and *S. perspicax*.

This species is referred to *Placobdella* only provisionally as until the structure of the reproductive organs, salivary glands, gastric caeca and the eyes are definitely known there will remain some uncertainty. The mouth is almost certainly in somite I at the tip of the cephalic sucker rim and the annulation and arrangement of sensillae and papillae are typically placobdellan throughout, which justifies the provisional reference. The caeca, so far as can be seen through the body wall, seem to be in 7 pairs profusely branched as in *Placobdella*. Unfortunately the single specimen cannot be dissected and the blood in the well-engorged stomach makes it so opaque and hard that practically nothing of the internal anatomy can be seen by clearing. The color pattern is distinctive and with the shape so like that characteristic of several species of *Theromyzon* that in the first sorting of the material it was provisionally assigned to that genus.

Placobdella fimbriata (Johannson). Plate 26, fig. 23.

Clepsine fimbriata Johannson 1909, p. 148; 1913, p. 8.

Placobdella fimbriata Pinto 1923, p. 133.

P. fimbriata, Moore 1933, p. 299.

Haementeria (P.) fimbriata, Autrum 1936, p. 74.

This very interesting leech has been excellently described and figured by Johannson. His account of the "gills", however, may be profitably supplemented. These structures, which are unique in the family so far as is known, are clearly derived from the thin marginal flanges which are more

or less evident in many leeches. They form the boundaries between dorsal and ventral surfaces and are based on the lateral sinuses but, except in certain Ichthyobdellidae, seldom attain any prominence. In the latter family they may give rise to broad lateral folds or wings (*Pterobdella*, *Phyllobdella*), to branchiae (*Branchellion*, *Ozobranchus*) or, with bulbous expansions of the lateral sinuses, to pulsating vesicles (*Cystobranchus*, *Trachelobdella*, etc.). The auricles of the Haemadipsinae also are derived from the marginal flanges of anal somites.

In the present species these folds, which undoubtedly function as gills, are confined to somites V to XIV. On V they occupy annulus *a3* and on XIV annulus *a1* only, but all annuli of intervening somites. Viewed casually from above or below they appear as metameric tufts somewhat like those of *Ozobranchus*, but from the sides are seen to be a continuous membrane deeply folded up and down. They are largest in the middle of the series and taper off toward both ends, terminating in a minute lobe on V *a3* and on XIV *a1*. The free margin of the fold is much longer than the attached base, which causes the strongly ruffled or fimbriated arrangement. On each somite the folds tend more or less toward an *S*-shape, with the most ventral part or the low point on *a2* and the most dorsal part intersegmental. Deep marginal incisions divide the membrane into primary lobes corresponding to the annuli and these again into from 2 to 6 small, flat, secondary lobes. All of the numerous specimens examined exhibited approximately the same arrangement. All are contracted and the deep folding and crowding of the lobes is due largely to this. On fully extended examples it is probable that the membrane would be simply wavy and that the primary lobes would stand out distinctly as belonging to individual annuli. Since the above was written smaller specimens have been studied. The smallest lack gills altogether, those from 5-7 mm. long have a longitudinal fold exhibiting little folding and lobation, features which develop gradually with increase in size.

Examination of the anatomy of this species shows that its affinities are with *Placobdella* rather than with *Glossiphonia* (*Clepsine*). This is indicated by the position of the mouth on somite I, the salivary glands and arrangement of the gastric caeca, the ♂ genital ducts and less importantly the annulation and papillation. The terminal mouth is unusually large and is continued back into the cephalic sucker by a median furrow. A pair of thick club-shaped salivary glands is connected with the caudal end of the stout pharynx in XI. Gastric caeca are 7 pairs arising in somites XIII to XIX. Those of the 1st pair are short and trilobed, the anterior lobe extending forward by the side of the atrium, the last pair long and reaching caudad into somite XXV, taking a zigzag course by the side of the intestine and provided with lateral lobes in each somite through which it passes. Caeca 2 to 6 are slender and reach nearly to the side walls of their respective somites, distally somewhat dilated and bilobed, the caudal lobe reflexed. The intestine bears the usual 4 pairs of long, simple caeca. The reproductive organs are of the *Placobdella* type, lacking altogether the long posterior loop of the sperm vesicle characteristic of *Glossiphonia* but found also in some *Placobdellae*. Both sperm vesicles and ducti ejaculatorii are

unusually long and complexly folded but the coils are close and compact, and the atrial cornua are very short and stout. Ovisacs have prominent anterior lobes and extend caudad in the ventral sinus to the 4th pair of testes at XVI/XVII.

Unlike the typical American members of *Placobdella* which have composite eyes in the sense that 2 pairs of small accessory eyes are incorporated in the same pigment mass with the principal pair, this species, so far as was determined on cleared specimens, lacks the accessory eyes and the large simple pair on III *a2* may be either quite separate (as usual) or united in a common pigment mass. The absence of the small eyes, however, needs verification on sections.¹ At the present time such a difference in the eyes does not seem to warrant generic distinction, as several species from India and Africa now referred to *Placobdella* present similar or other equally great variations in eye arrangement and a wide range has long been recognized in the genus *Glossiphonia*. Much more important, however, is the presence of gills, a character unique among the known species of the family and probably an adaptation to a low oxygen content of the water in the peculiar habitats affected by this species. Probably this character will lead eventually to generic separation.

Benue River, Nigeria, W. B. Johnson, Feb. 17, 1922, leg stump of crocodile, 25, "natural color green"; Worthington Coll., Apr. 4, 1928, Sta. 62, No. 2, Murchison Falls, Victoria Nile, Uganda, tongue of crocodile, 40, "color green", several bear spermatophores; same, 1931, Sta. 217A (1), Ferguson Bay, Lake Rudolf, Kenya Colony, Jan. 2, mouth of crocodile, 4; Uganda Veterinary Service (R. W. M. Mettan), Fazel Din Ahmedi, Coll., Entebbe, Uganda, No. 425, Sept. 2, 1933, 150 (including young) from pharynx of crocodile.

Theromyzon cooperi (Harding). Plate 25, figs. 10, 11.

Placobdella cooperi Harding 1932, p. 83.

Hacmenteria cooperi, Antrum (sp. inq.) 1936, p. 82.

Glossosiphonia tessellata, Brumpt. 1901, p. 123.

Harding's species was based upon two indifferently preserved specimens in the Omer-Cooper Abyssinian Collection and in the absence of knowledge of the internal anatomy was referred to *Placobdella* only provisionally. A single specimen of what is undoubtedly this species was found in the American Museum collection taken by Dr. Barnum Brown in Abyssinia.

With certain reservations it agrees with Harding's description in all respects—form, color, annulation, eyes, position of sex pores, papillation, etc. It is strongly contracted and measures 13. x 6.8 x 1.5 mm., the caudal sucker 2.3 mm. in diameter. It has the peculiar soft, almost gelatinous texture characteristic of this genus. The annulation agrees with Harding's figure except that the preocular region, which is folded ventrally into the

¹ This has since been done on two series of sections.

oral sucker and divided by a deep median cleft, may be readily determined as constituted of somite I with the included apical lobe. Evidently in Harding's material the lip was much more contracted and somite I was overlooked. This makes it necessary to add one somite to Harding's enumeration, which places the eyes, gonopores and anus all in the normal positions. The mouth is clearly seen far in advance of the center of the oral disk and yet not at the apex of the sucker rim as in most species of *Placobdella* but between these two points and apparently in somite II with the 1st pair of eyes. In the position of the mouth and greater reduction of the anterior cephalic somites this differs from typical members of the genus and resembles *T. occidentalis* (Verrill). As Harding states, there are no large papillae but numerous minute ones scattered irregularly over all annuli. Unfortunately the integument proved to be so opaque and the internal organs so obscure that several efforts at clearing proved futile in yielding any anatomical information.

American Museum of Natural History No. A 5773, Abyssinia, B. Brown, 1 specimen, with *P. stuhlmanni*.

ICHTHYOBDELLIDAE (Piscicolidae)

PHYLLOBDELLA, new genus

A foliaceous ichthyobdellid related to *Pterobdella*, externally parasitic on fishes and resembling superficially an ectoparasitic trematode. Body divided into two parts as in *Branchellion*, etc., the middle region with wide, thin marginal expansions richly provided with mucous glands but without pulsatile vesicles; somites divided into numerous (12?) obscure, irregular annuli; integument without papillae or warts; eyes vestigial; ♂ and ♀ pores opening into a common genital sinus; posterior pair of reflexed gastric caeca apparently absent; testes 5 (or possibly 6) pairs alternating with gastric caeca; penis sac very short and atrial cornua and ejaculatory ducts with their investiture of prostate glands massive and reaching cephalad to ganglion IX; vagino-uterine sac well developed with many deep, circular, lining folds. Genotype *P. maculata*, new sp.

Phyllobdella maculata, new sp. Plate 25, figs. 13-15, and text-fig. 1.

The type specimen measures in mm.: Length 16.3; length to ♂ pore 5.; widths, buccal ring 3., ♂ pore 2.7, maximum (about XV) 11., anus 2.8; depths in median plane nearly uniformly from 1.5 to 2, the wings estimated as approximately 1 mm.; diameter of caudal sucker 3.8 mm. Other specimens have approximately the same proportions and vary in length from 12. to about 18 mm.; the latter, which is the largest, is much distorted and strongly contracted and has a maximum width of 20 mm.

Divided in typical ichthyobdellid fashion into anterior head and "neck" and posterior "abdomen" or body proper and presenting a short raquet- or paddle-shape. All are very strongly contracted, with the body discoid and

roughly circular and the neck or handle short. Apparently capable of a wide range of contraction and extension, it is probable that in normal elongation they would have a form more like a cricket bat with a thin, wide, marginal fold on each side.

Anterior region with the form usual in the *Branchellion* section of the family, contributing approximately $\frac{1}{4}$ or less of the total body length and being $\frac{1}{4}$ or less of the maximum body width. Head in contraction short capuliform, hemispherical, little expanded, deeply hollowed ventrally, with a small papilla on which the minute mouth is situated slightly caudad of the center. Rim smooth and regular. Both longitudinal and circular muscles are obvious on the ventral face, the latter only conspicuous on the dorsum. Dorsum smooth, without papillae and showing only a few inconspicuous shallow furrows. Eyes problematical, imperfectly developed. In sections one or two visual cells were detected, associated with a faint pigment spot, on each side of the buccal ring. A similar pair of eye spots is present on the rim of the sucker anterior to the mouth. On the dorsum of the head close to its caudal margin and separated from each other by about $\frac{2}{3}$ of the width of the head is a pair of larger, more or less conspicuous pigment spots. No associated visual cells could be detected on entire specimens, but in sections, 2 or 3 appeared on each side. Thus 2 or 3 pairs of imperfect eyes are indicated. Besides these, some of the specimens have other pigment spots on the head, in one case there being a crescent of 8 small spots on the posterior part. "Neck" somewhat depressed, elliptical in cross-section, widest in the middle, somewhat constricted at both ends; constituted of 2 regions, the preclitellar, which is wider and contributes about $\frac{2}{3}$ of the total length, and the clitellar which is only $\frac{1}{2}$ as long as the former and smaller in both transverse and dorso-ventral measurements. Preclitellar region barrel-shaped in outline as seen from above or below, marked with many irregular, shallow cross-furrows; otherwise smooth and lacking in salient features. Clitellar region distinctly contracted in both diameters and separated from the preclitellar anteriorly and the body proper posteriorly by deep annular furrows. It is somewhat sunken into the latter, a fold of which envelops its caudal end, although this prepuce-like feature is less pronounced than in some other genera of the family. A thick layer of clitellar glands makes the interannular furrows even more obscure than on the pre-clitellar region. Gonopores differ in appearance in different specimens. On the type and 2 other specimens the large δ gonopore is situated at the bottom of a crater-like depression bounded by a glandular rim, on the caudal margin of which is the minute $\varnothing$ gonopore. On another specimen the cavity of the crater is largely filled by the stout, knob-like penial process of the atrium, which projects from the orifice of the δ bursa. In the specimen sectioned the crater and bursa together form a deep, more contracted sinus, the lining epithelium of which is deeply folded and which receives the $\varnothing$ gonopore into its posterior part, the whole being surrounded by an opaque glandular area.

Body proper, which includes the middle body and anal regions, petaliform, foliaceous, roughly discoid, the margins very thin and thrown into broad irregular ruffle-like folds; the ends broadly bilobed with deep emarginations to accommodate the clitellar region anteriorly and the caudal sucker

peduncle posteriorly, both of which are embraced laterally by the paired lobe-like extensions of the body margins. On all of these strongly contracted specimens this discoid region is wider than long and is composed of a median part of about $\frac{1}{3}$ of the total width which contains the organs of digestion, reproduction, excretion, etc. and is of about the same depth as the neck, and of the very thin marginal expansions which together make up $\frac{2}{3}$ or more of the width and contain chiefly the lateral and connecting sinuses and great numbers of unicellular glands, some of very large size. There are no separate gills, papillae or other prominent distinctly segmental characters. The cross-furrows are much crowded, irregular and confused and connected by numerous short longitudinal furrows which divide the integument into small, irregular, quadrate areas. These include unicellular integumental glands and bear numerous very minute papillae. On the venter 49 longitudinal muscle bands were counted and probably a few more uncounted ones at the margins should be added. Owing to greater opacity the count of dorsal bands was less satisfactory but apparently the number is about the same. Caudal peduncle well defined and rapidly tapered, bearing the minute anus on its narrowest part. Sucker hemispherical, cup-shaped, with contracted rim on some, discoid on other specimens.

Color: Largely faded and altered by reagents. Ground yellowish gray, inclining on different specimens more or less to one or the other shade of varying degrees of intensity and more or less suffused with dusky. Very characteristic are the brown or black spots more or less conspicuously developed on all parts of the body, including cephalic and caudal suckers. These appear to be segmental, a transverse row occurring on each metamere. Typically there are 4 series on the neck region and 6 or 8 on the body proper. Under slight magnification they appear as small, round spots differing much in intensity and sharpness, those in the paramedian and intermediate series of the middle body region being most often faded or obsolete and those on the ends and margins—the peripheral parts generally—most heavily pigmented. Apparently these spots are single very large melanophores, consisting of a central spheroidal body, about .15-.25 mm. in diameter and in the darkest specimens as dense and black as a little ball of India ink. From this radiate dendritic processes greatly variable in extent, number and complexity. In no case was the nucleus seen. On the caudal sucker is a submarginal circle of 8 to 14 smaller spots and on some specimens an additional inner circle of about 6.

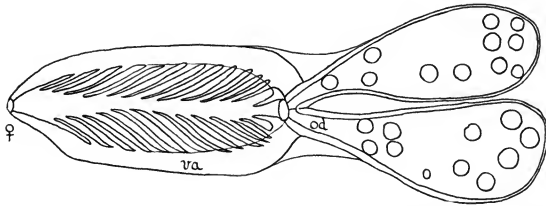
Annulation: Owing to the extreme contraction with consequent crowding of the annuli and frequent obliteration of the furrows together with the absence of conspicuous external somite features little can be made of the metamerism and annulation. The ventral nerve cord also is so tortuous and the ganglia so crowded and displaced that they proved of little value in checking somite limits. The completion of this part of the description must await the study of more extended examples. On the middle body region the presence of primary, secondary and tertiary annuli is certain, but beyond ascertaining that complete somites are almost certainly 12-annulate, as in some other genera of the family, little more could be determined. On the neck 27 or 28 of the ultimate annular divisions were counted between the oral ring or posterior rim of the cephalic sucker and the caudal end of the preclitellar region but they could not be systematized or satisfactorily

aligned with somites. On the clitellar region not even a satisfactory count of annuli could be made.

Anatomy: The internal anatomy was studied on a series of transverse sections and some of the features verified on entire cleared specimens. The peripharyngeal chamber reaches from the mouth to somite IX and is lined throughout by a thin epithelium. The retracted proboscis begins at the level of the circumoesophageal nerve ring and reaches to the caudal end of IX posterior to the ganglion. Anteriorly it is terete, posteriorly somewhat flattened with a trifid lumen, the 3 muscular ridges being median dorsal and paired ventral at the anterior end and twisted to median ventral and paired dorsal at the posterior end as in some genera of Erpobdellidae. The stout paired retractor muscles diverge from its caudal end to merge with the general body musculature. Diffuse bundles of small salivary glands open into its posterior end. The short, inconspicuous, S-shaped oesophagus in somite X is pushed against the dorsal body wall by the enlarged atrium and its glands. Six pairs of gastric caeca in somites XIV to XIX are simple, apparently unbranched, and bulbous at the free ends, which reach to the sides of the body proper and not at all or only very slightly into the lateral expansions. There appear to be no posteriorly directed gastric caeca but owing to the condition of the material it is possible that they were overlooked. The walls of the intestine are much thicker than those of the stomach and deeply folded. The intestine bears 4 pairs of long, simple, inflated caeca and tapers into a very slender rectum which opens by an exceedingly minute anus at the base of the sucker peduncle.

As mentioned above, the gonopores open close together more or less into a common genital sinus, the large ♂ orifice being at the bottom of the depression, the minute ♀ pore on its caudal margin, the two being separated by little more than the length of ganglion XII. The ♂ bursa, which opens into the crateriform sinus, is a thin-walled sac of moderate size, the ventral division of which is lined by a deeply folded epithelium and the larger dorsal chamber by a smooth epithelium. Into the roof of the latter the atrium opens by an orifice through which the conjoined atrial horns project as a small, conical, penial papilla. The atrium proper is a short, cylindrical, thick-walled, muscular chamber or penial sac which extends cephalad to somite XI and divides gradually into the pair of large cornua of similar structure except that the lining epithelium is thinner and lumen relatively larger. The cornua reach far forward to ganglion IX, where they bend dorsad sharply on themselves, lose most of their thick muscular coat and become transformed into the narrower, soft-walled epididymi which consist of a few folds lying dorsal to the cornua, and again return to somite XII, gradually diminishing in diameter and tapering to the very slender vasa deferentia. With the exception of the posterior, slender, more coiled portion of the epididymis the tubes are completely enveloped in a thick layer of large, deeply-staining, pyriform prostate gland cells with prominent spherical nuclei, and similar cells envelope the whole anterior bend of the cornua. Another large bilobed median mass of these cells covers the atrium, into which they appear to empty. The vasa deferentia are the usual delicate tubes lying on each side near the dorsum and like the epididymis are filled with sperm. Five pairs of large testes sacs were discriminated but, as they are much crowded together and overlap and extend from XIII/

XIV well into XIX, alternating with the gastric caeca, it is surmised that there may be really 6 pairs. The ♀ organs (text-fig. 1) consist of a short vertical vaginal canal leading from the ♀ orifice to the short, straight, cylindroid uterine sac which lies in the subneural sinus and reaches to the caudal part of somite XIII. This is lined by a small-celled epithelium remarkable for being arranged into 12 or 13 deep, concentric, overlapping circular folds which fill the greater part of the lumen and the spaces



TEXT-FIGURE 1. *Phyllobdella maculata*. Outline drawing of a frontal section of the ♀ genitalia $\times 6\frac{1}{4}$. O ovisac containing mature ova, od oviduct, va vagina, ♀ female pore.

between which, as well as the central lumen, are packed with spermatozoa and the latter with a few ova. The folds appear to serve the purpose of a spermatheca. External to the mucous layer is a thick coat of circular muscles and a thinner one of longitudinal muscles, then a layer of connective tissue and gland cells of two kinds, one large, globular, pyriform with large nuclei, the other small, clavate with very deep-staining nuclei, and finally a thin endothelium. Toward the ental or caudal end both the circular muscular and the glandular (especially the large cells) layers increase in thickness and the lumen diminishes. It terminates in a short, unpaired oviduct with a very narrow lumen and thick muscular walls which receives the short, paired ducts of the two ovate ovisacs. The ovisacs lie in the ventral sinus and reach from XIII/XIV to ganglion XV. The marginal expansions of the body are extraordinarily rich in very large mucous glands, smaller numbers of which occur in the body proper also.

The type and four others were taken by the Pask-Christy Tanganyika Exp. at Sta. 432S., Kirando, east shore of Lake Tanganyika, from the tail of *Barbus tropidolepis*, Oct. 16, 1926. Type in British Museum of Natural History.

With the leeches there were also some pieces of fins and skin of the host showing deep circular scars bounded by a somewhat raised rim which had evidently grown over the margins of the attached suckers.

So far as now known the closest ally of *Phyllobdella*, and the only genus with which it has much in common, is *Pterobdella* described by Kaburaki (1921) from a single species parasitic on stingrays in Chilka Lake, Orissa, India. The characters common to both are thin marginal expansions of the

body, annuli of complete somites numerous (12-14) but very irregular and obscure, no pulsating vesicles, eyes vestigial or absent, ♂ and ♀ organs opening at a common external pore or into a common genital sinus, no posterior pair of reflexed gastric caeca, and testes 5 pairs. The principal differences are: *Pterobdella* has the lateral expansions divided into two parts, on the anterior and middle regions of the body respectively, whereas *Phyllobdella* has the latter only but much wider and extending farther caudad; *Pterobdella* has a long penis sac and the atrial cornua not reaching cephalad beyond XI, while in *Phyllobdella* the former is very short and the latter extend far forward to ganglion IX and are provided with large prostate glands; in *Pterobdella* the vagina and uterine sac appear to be little developed, while in *Phyllobdella* the median sac is large and provided with a complicated mucous lining.

Further study of better material may necessitate some modification of this comparison but it is evident that these are two closely related but distinct genera, each with a single known species.

HIRUDIDAE

Myxobdella africana, new sp. Plate 26, fig. 24; pl. 28, fig. 51.

Unfortunately this interesting species is represented by a single excessively contracted and very badly preserved specimen only, which makes a complete and satisfactory description impossible.

Measurements in mm.: Length 53., to ♂ pore 8.; widths, buccal ring 8., at ♂ pore 12., maximum (ca XX) 24.; depths, buccal 5., ♂ pore 9., somite XX 11.; sucker 13. mm. Form, strongly contracted, ovate-pyriform, twice as long as the maximum width, rounded anteriorly, moderately flattened with rounded margins posteriorly. Lip broad and rounded, its venter much furrowed all round. Eyes small and obscure as in *Haemopsis* but apparently the 5 pairs arranged in the usual way on a2 of somites II to VI.

No external indication of a clitellum. Gonopores separated by 5 annuli, the ♂ at XI *b5/b6*, the ♀ at XII *b5/b6*, both small, round orifices deep in the furrows. Owing to excessive contraction the nephropores are hidden in the furrows but 2 pairs of vesicles dissected out show that they occupy the usual position on the caudal margin of *b2*. Some of the segmental sensillae can be seen as small, round, white spots arranged as in *Haemopsis*. In addition there are 80 to 100 small, pointed sense organs in a single transverse row on each annulus. The integument shows the peculiar oedematous texture of *Myxobdella* notwithstanding the contraction resulting from immersion in alcohol. Anus the usual small furrowed aperture behind XXVII, followed by one small annulus. Caudal sucker very large, even in contraction, circular, flat, very muscular and unusually thick. Color dark slate above and below, finely and obscurely mottled with black.

Annulation: Obscured and altered by the engorgement and contraction of the specimen but the primitive plan characteristic of *Myxobdella* is evident. Most of the complete somites show the 2-1-2 grouping of annuli.

Frequently the intersegmental constrictions are very deep, especially on preclitellar somites and most of all between VII and VIII. The constitution of somites I to IV could not be determined. IV, V and VI form the buccal and post-buccal rings. V, VI and VII are 3-annulate, VIII 4-annulate and IX to XXIII inclusive 5-annulate. XXIV is 4-annulate ($b1 = b2 < a2 = a3$) and the first 2 annuli ($b1$ and $b2$) are less separated than the others; XXV 3-annulate $a1$ ($b1$ $b2$) $> a2 > a3$; XXVI 2-annulate and XXVII 2-annulate slightly at the margins only.

Anatomy: Careful partial dissection yielded the following data: Jaws small and bearing about 12 irregular distichodont teeth. Buccal sinus injured so that the apparent projection of the end of the pharynx and velum to form a papilla is not certain but probable. The gastric caeca are fully distended with blood and are 2 pairs per somite in the genital region, the only place where they were exposed. A partial dissection of the reproductive organs (fig. 51) from the ventral side shows that the 1st pair of testes at XIII/XIV are very large. Just anterior to this the vas deferens loses the glandular covering and becomes very delicate, smooth and straight. In somite XI it bends mediad across the cephalic face of the epididymis, where it is very slightly enlarged to form a small fusiform spermatie vesicle about 2.5 mm. long and .3 mm. in diameter opening into the cephalo-median end of the massive epididymii, which in the natural position conceal the atrium from above. The latter is somewhat flattened cephalo-caudally, measures $4 \times 3.5 \times 2$ mm. and consists of a soft, cream-colored, intricately and irregularly folded tube of a diameter 4-6 times that of the vas deferens, arranged, as usual, in a U-shape, the 2 limbs of which, however, exhibit no appreciable difference in the diameter of the tube, as in many genera. The shorter median ventral limb joins the atrium at the junction of the penis-sac and prostate by a short direct ductus ejaculatorius, without enlargement into an ejaculatory bulb. The atrium lies entirely ventrad to the nerve cord immediately caudad of ganglion XI. It is remarkably small, measuring 3 mm. in total length, of which $\frac{2}{3}$ constitute the penis-sac and the rest the prostate, the respective diameters of which are .8 mm. and 1.3 mm. The whole has a somewhat compressed conical form, the ventral penis-sac standing vertically at right angles to the ventral body-surface and the prostate bent forward at an angle of about 30° and flattened on the dorsum by the pressure of the blood-filled stomach. It is enveloped in a thick layer of prostate glands which overlap the penis-sac as a scale-like sheath. The $\varnothing$ organs also have been somewhat distorted by pressure. The ovisacs lie in the usual position in XII, are flattened globoid pyriform and measure about 1.5 mm. in diameter. They give rise to the paired oviducts, which are very short, less than the diameter of the ovisacs, and meet on the right side of the nerve cord in a stout common oviduct thickly covered for most of its length with albumen glands. The common oviduct continues into a short uterine or vaginal portion, from which it is distinguished only by a slight constriction, and a very small vestigial caecum, the vagina presenting only the slightest enlargement. The whole organ measures only 8 mm. in length, of which the vagina contributes slightly more than one-half, with a diameter varying from .5 mm. in the common oviduct to .8 mm. near the vaginal orifice. All nearly white in color. Although the dissection was necessarily very incomplete and much remains to be learned, the anatomy, so far as

known, agrees very closely with that of *M. annandalei* as described in the "Fauna of British India" (Moore 1927).

The only representative of this species was taken at Nairobi, Kenya Colony, on Jan. 4, 1916, by an unnamed collector for the British Museum, no further data being available. Type in British Museum of Natural History.

Myxobdella maculata, new sp. Plate 27, fig. 27; pl. 28, fig. 50.

The type is elongated ovate-cuneate, the posterior $\frac{3}{4}$ rather broad and depressed as a result of distention by the partly filled gastric caeca, the pregenital $\frac{1}{4}$ moderately slender, rounded, and tapering; the former part hard and rigid, the latter soft and flexible; margins rounded.

Measurements in mm.: Length 51., to δ pore 9.5; widths, buccal 2.8, δ pore 7., maximum (XX) 13.4, anus 6.; depths at same points, 2., 3.6, 10.5 and ca. 2.; caudal sucker 11 mm. Head and anterior sucker small, with the lip bilobate from a median cleft which extends only a very short distance on to the ventral surface. Eyes 5 pairs, the first 3 largest, close together in an arch on the 2nd, 3rd and 4th annuli, the 4th pair smaller, on the 6th annulus, and the 5th pair very small and obscure, on the 9th annulus. The buccal chamber has the characteristic structure of the genus, the solid velum projecting forward as a low papilla, perforated at the center and apex by the minute pore-like mouth. No evident clitellum. Gonopores separated by 8 annuli; the δ at XI $a2/b5$, a small pore at the apex of a small, low papillae in a smooth elliptical area surrounded by a slightly raised ring; the φ a rather large and obvious orifice in the furrow XIII $b1/b2$. Anus a conspicuous opening in the caudal border of XXVII, apparently with no definite annulus following it. Caudal sucker very large and thick but in this specimen much contracted and inrolled so that its full size is not apparent. Integument soft and somewhat bloated, much crinkled and cut into little areas by many short, longitudinal furrows, with numerous minute sense organs but no definite papillae. Sensillae and nephropores like those of *Haemopsis* and other species of *Myxobdella* but actually seen on only a few somites, including the clitellar somites, which helped to fix definitely the position of the sex pores, determined also by the position of the ganglia. Color faded to a nearly uniform yellowish-gray, fairly uniformly and plentifully spotted with small, irregular black blotches, fewer below.

Annulation: Distinct except on somites I to III, but owing to the strong and irregular contraction of the annuli their relative lengths are difficult to determine. I (including the prostomium) is cleft in the middle to form a bilobate preocular lip. II and III each 1-annulate but much crowded, united in the middle and distinct only at the margins, and bearing the first 2 pairs of eyes. IV 2-annulate, the 2 annuli approximately equal and the 1st bearing the 3rd pair of eyes. V 2-annulate dorsally, ($a1$ $a2$) $> a3$, bearing eye 4 on the 1st annulus, the 2 annuli united below to form the buccal ring. VI 3-annulate dorsally, $a1 = a2 = a3$, eye 5 on $a2$, ventrally $a1$ and $a2$ unite to form the post-buccal ring which is $> a3$. VII 4-annulate, $a1$ (with a very short $b1$ slightly and irregularly differentiated from its anterior border²) $> a2 = b5 = b6$. The furrows VI/VII and VII/VIII are

² The partial annulus described as VII $b1$ may be, in reality, VI $b6$.

much deeper than any neighboring ones. VIII 5-annulate, $b1 = b2 < a2 = b5 = b6$; the furrows $b2/a2$ and $a2/b5$ deeper than the others. IX-XXIII 5-annulate, all approximately equal but the 2-1-2 grouping of $b1$ and $b2$, $a2$, $b5$ and $b6$ more or less evident on all. XXIV 4-annulate, $b1 = b2 < a2 = a3$. XXV 3-annulate $a1 = a2 > a3$. XXVI 2-annulate, the 1st annulus smaller and the sensillae on the anterior part of the 2nd, $a1 < (a2 \ a3)$?. XXVII 1-annulate with a slight marginal furrow.

Anatomy: Inasmuch as this species is represented by a single specimen, dissection was prohibited beyond what was necessary to display the essential features of jaws and reproductive organs. Velar or oral papilla well marked, projecting into the buccal cavity and perforated at the summit by the small mouth. Jaws small, with sharp, compressed dentinal ridges. Teeth all lost or broken but some fragments indicate a distichodont arrangement with the number undetermined. Gastric caeca begin as a minute pair in X with increasingly larger but simple pairs in XI and XII and 2 pairs, the longer lobulated and obliquely overlapping the wide, almost simple, short ones in XIII and XIV, the last somite dissected. Reproductive organs (fig. 50) very similar to other species of the genus. Atrium very short, not rising above the nerve cord, the enlarged prostate completely concealing the penisac from above. Ducti ejaculatorii lacking any enlarged bulb and extending directly laterad from the dorsal angles of the prostate, extensions of which partly cover them, to the cephalic end of the ventral limb of the epididymi. Epididymi massive, reaching from immediately behind ganglion XI to ganglion XIII and, before being displaced, in contact medially, compressing the anterior end of the stomach between them and completely hiding the atrium and much of the ♀ organs from above. The ectal limb is ventral, formed of a much folded narrower tube and hidden by the dorsal ental limb which consists of a few folds of a very coarse tube, possibly swollen by the preserving fluid. From its cephalic end, which tapers rapidly, the capillary vas deferens bends caudad to run the usual course on the ventral longitudinal muscles; no enlarged sperm vesicle or ejaculatory bulb, as in *M. africana*. First pair of testes at XIII/XIV, others not dissected. ♀ organs on right of nerve cord. Ovisacs as usual at XII/XIII, with very short paired oviducts; common oviduct more than twice length and $\frac{1}{2}$ the diameter of vagina, arranged in a few folds in contact with vagina and opening on one side just below its end; oviducal gland cylindrical, covering about $\frac{1}{2}$ of the common oviduct to the point of bifurcation into paired oviducts. Vagina cylindrical, without enlargement or division into stalk and sac but with a minute caecum.

Lang-Chapin Congo Exp., Mopu, Belgian Congo, No. 705, Jan. 1914. Type only. Type in American Museum of Natural History.

For discussion of this species and *M. africana* see p. 332.

Praobdella guineensis Blanchard. Plate 26, fig. 26; pl. 28, fig. 52.

Praobdella guineensis Blanchard 1896, p. 52.

This species, as exemplified by the single excessively contracted and moderately engorged individual, is a large, robust leech resembling in shape similarly contracted individuals of both *Dinobdella ferox* and *D. notata*, especially the latter. The deeply folded annuli indicate that it is capable of great extension.

Form as contracted, broadly subovate, the greatest width behind the clitellar region at about XVI, caudad of which longitudinal contraction is not quite so excessive; tapering from this point gradually to the broadly rounded, caudal end; strongly convex dorsally, nearly flat ventrally; margins narrowly rounded.

Measurements in mm.: Length ca. 51., to ♂ pore 5.5; widths, at buccal ring 4., at ♂ pore 13., maximum (XVI) 23., at anus 8.; depths at same points 2., 8., 13., and 4.5 respectively; diameter of caudal sucker 14. Upper lip exceedingly small, contracted and deflexed into mouth, much folded and wrinkled. When straightened out it presents a well marked median cleft causing it to appear bilobed anteriorly, as is often the case with similarly contracted *Haemopsis*, but on venter smooth with no median furrow. Eyes very small and obscure but probably 5 pairs in all. Those actually seen are the first 3 pairs on II, III and IV, much crowded and forming an irregular arch disarranged by the contraction and folding of the annuli, and the even smaller and somewhat doubtful eye of the right side of the 4th pair on the 1st annulus of V. The left eye of the 4th pair and both of the 5th pair could not be discerned at all. Buccal ring furrowed all round, formed by the united annuli of V with IV *a3* at the margins. Post-buccal ring formed by VI (*a1 a2*). Clitellum indicated by a thick glandular layer in the genital region but its boundaries not clearly defined. Gonopores separated by 7 annuli, both rather large, simple openings in the furrows, the ♂ at XI *a2/b5*, the ♀ at XII/XIII. Nephropores mostly clearly visible, seen on most somites from IX to XXIII but not on VIII or XXIV. They occupy the usual position in the intermediate line on *b2*, but instead of being rounded, pores are transverse slits as a result of the compression of the annuli. Sensillae visible as very minute, round, white dots in the usual position on a few posterior somites, elsewhere indiscernible. No definite papillae. Anus a transverse slit with furrowed margins at base of caudal sucker. Sucker very large, massive and muscular, with thin margin and numerous irregular, radiating, ventral furrows, evidently capable of great expansion; dorsum roughened with many short irregular wrinkles. Color faded to a grayish olive brown both dorsally and ventrally, sparsely speckled with irregular black spots, larger and more numerous above.

Annulation: As a result of excessive contraction the annuli are mostly pressed into deep, crowded folds (especially on the venter, toward which the leech is curved) which are further puckered transversely and cut by many short irregular wrinkles. While the annuli are easily counted, their relative length and relation to one another is largely lost. The nephropores, however, give the clue to somite limits throughout the middle body region, and on the venter the deeper intersegmental furrows usually engulf the medial part of *b1*. On preclitellar somites the annulus *b6* is very regularly retracted on the ventral face and partly covered by the contiguous annuli *b5* and *b1*. Somites I-IV, constituting the lip, extremely short and crowded, with the cross furrows very irregular, broken and ill-defined. However, 5 annuli can be distinguished, a preocular, 3 bearing the first 3 pairs of eyes and a 5th behind the 3rd pair of eyes, representing IV *a3*. This makes somites I-III each 1-annulate and IV 2-annulate. Behind IV is a deeper furrow marking the buccal ring. V 2-annulate dorsally, with a small eye on the right side of the first annulus, united below to a single annulus and laterally with IV

$a3$ to form the buccal ring. VI 3-annulate dorsally, $a1$ and $a2$ united at sides and more completely ventrally to form the post-buccal ring, which in the middle field is scarcely distinct from the buccal ring; $a3$ is much reduced and covered in the mid-ventral field by VI $a1$ $a2$. VII 4-annulate, $a1$ paired with $a2$, and $b5$ with $b6$, with a deeper $a2/b5$ furrow between; ventrally $b6$ is only partially exposed. VIII 4-annulate both dorsally and ventrally, similar to VII but larger ($a1 = a2 > b5 = b6$). IX 5-annulate ($b1 < b2 = a2 = b5 = b6$), $b1$ partly concealed in VIII/IX; nephropores clearly visible as minute, paired transverse slits on $b2$. X 5-annulate, similar to IX but larger; relative depth of furrows $b1/b2 < b2/a2 = b5/b6 < a2/b5$. XI to XVI inclusive, similar. On all of these the intersegmental furrows are deeper than the intrasegmental and $b1$ is partly retracted. XVII to XXIV all 5-annulate with all annuli approximately equal, except that on XXIV $b5$ and $b6$ are slightly reduced, especially on the ventral face. In this region contraction is less extreme and the body nearly straight, with the result that $b1$ is fully exposed and the annuli not quite so deeply folded. XXV 4-annulate, $b1 = b2 < a2$ slightly $< a3$. XXVI 3-annulate, $a1 > a2 > a3$. XXVII 2-annulate at margins, united into one medially.

Anatomy: Mouth and velum as in *Dinobdella*. Jaws very small and strongly retracted into their crypts, the apical region compressed to a high, sharp, dentinal ridge, no trace of teeth or salivary papillae visible, but the teeth may have been lost. The jaws proved to be so brittle that the one extracted for microscopic study was badly broken.³ Stomach largely filled with very hard blood; only a few of the anterior gastric caeca were exposed, which appear to resemble those of *D. notata* rather more closely than *D. ferox*, but the large caeca overlap somewhat more, thus approaching the latter in this respect. Reproductive organs (fig. 52) small for the size of the animal. ♂ organs resemble those of *D. ferox* most closely. Atrium of the form of that species but relatively much shorter, probably due to contraction, consisting of a cylindrical penis sac only about 3 or $3\frac{1}{2}$ times as long as its diameter, and a thickened glandular prostate region slightly more than twice the diameter of the penis sac, truncate and somewhat inverted pyramidal in shape, the whole atrium rising only slightly above and to the right of the nerve cord. Ducti ejaculatorii appear from among the glands at the lateral angles of the prostate and diverge laterally to a length only about equal to the diameter of the prostate and continue into the ventral end of the caudal limb of the epididymis without enlarging into a muscular ejaculatory bulb. Epididymis on each side of atrium a globoid mass of thin-walled tube about equal in size to the prostate, of the usual inverted U-shape with the opening ventrad and the two limbs caudad and cephalad. The tube of the caudal limb rapidly increases in diameter from the ductus ejaculatorius and consists of closely compacted folds passing into the cephalic limb which is similar but of somewhat greater diameter and with fewer folds, finally contracting rapidly at its ventral end and turning sharply first laterad and then caudad to taper into the narrowly meandering capillary vas deferens. Testes not dissected. ♀ organs almost exactly like those of *D. ferox*. As exposed undisturbed they form a compact globular mass on the right side of the nerve cord crowded against the ♂ organs and

³ On a second jaw, removed later, remains of 16 coarse broken teeth arranged irregularly in two rows were counted. The original number probably was greater.

with the ovisacs at the dorso-cephalic part of the mass, neither of them crossed by the nerve cord. Vagina much elongated, with no external division into vagina proper and common oviduct, tubular, firm and muscular throughout, about 4 times the length and $\frac{1}{2}$ the diameter of the atrium at the prostatic end, the ratio of its own length to diameter being about 20 to 1. At the official end there is a slight bulbous expansion, the remainder being fairly uniform from $\frac{1}{3}$ to $\frac{1}{2}$ mm. in diameter, the differences being due to varying compression of the compact folds. There is no caecum and no external distinction into sac and stalk, but the inner end tapers somewhat to the point of bifurcation of the oviduct, there passing with no definite albumen gland into the short S-shaped, paired oviducts which join the pyriform ovisacs, the later being about $\frac{1}{4}$ the size of the epididymi. All of the reproductive organs are much compressed and flattened by the contraction of the leech.

Monrovia, Liberia, 1926, J. Bequaert, 1 specimen.

Praobdella guineensis was described very briefly from a single example 45 mm. long taken at Bismarckburg in Togoland. Blanchard referred it doubtfully to his genus, of which *P. büttneri* is the genotype and only other described species. Nothing is known of the internal anatomy of either. Should the anatomy of *P. büttneri* later prove to be in agreement with *Dinobdella ferox* and what is herein reported for *P. guineensis*, *Dinobdella* may become a synonym of *Praobdella*. The Liberian specimen resembles *P. guineensis* in the general uniformity of color, obscurity of the eyes, (which Blanchard failed to find) separation of the gonopores by 7 annuli (Blanchard places both $\frac{1}{2}$ annulus farther caudad), large size of the caudal sucker and in the annulation, except that Blanchard figures XXV as 5-annulate whereas in the present specimen it is only 4-annulate. The differences are no greater than what may be expected of individual variation or in the interpretation by different observers of specimens differently preserved.

Comparison of this species with the two species of *Myxobdella* and especially with *M. maculata* is required. Unfortunately each of the three species is represented by a single poorly preserved specimen. It is impossible to give full descriptions, as complete dissection is prohibited and the bad state of preservation necessarily compels caution in arriving at conclusions based upon single and possibly variant individuals.

There can be no doubt regarding the proper generic assignment of *M. africana*. Although the buccal region of the type is somewhat mutilated there is little doubt that the velar papilla and small mouth opening are as typical of the genus. In all important respects of external morphology, color pattern, and of reproductive organs and alimentary canal, so far as determined, it agrees with *M. annandalei*. It differs mainly in the somewhat greater elaboration of somites V to IX (which are variable in *M. annandalei* and probably in *M. africana*) and XXIV and in having a greater number of distichous teeth.

With *M. maculata* the case is quite different. While it resembles other species of *Myxobdella* in the character of the mouth parts and nearly all features of the reproductive organs and external morphology it differs widely in certain respects, especially in the unusual position of the gonopores and the presence of an additional annulus each on somites VII, VIII and IX, together with some other minor differences in annulation. In the reproductive organs the slight vesicular enlargement of the vas deferens just before it enters the epididymis, present in *M. annandalei* and *M. africana*, is absent in this specimen, and the ♀ organs, while exhibiting the same minute vaginal caecum and other characteristics, differ in the proportions of vagina and oviduct and the extent of the oviducal glands. The teeth of the types of both of the new species are so badly damaged or lost that little reliance can be placed on them. The unusual position of the gonopores naturally leads to the consideration whether this may not be a species of *Praobdella*. The ♀ pore is situated exactly as in *P. büttneri* Bl. and the male pore is one annulus farther cephalad than in that species, a range of variation not unusual in leeches the gonopores of which are atypically situated. The annulation of this species differs from that of *P. büttneri* nearly as much as from *M. annandalei*. The irregularly spotted color pattern differs greatly from the regular metameric pattern of *P. büttneri* as described by Blanchard from a young individual. In the absence of any information regarding the mouth and internal anatomy of *P. büttneri* and as the new species conforms to the *Myxobdella* plan in respect to these it is provisionally referred to that genus.

The specimen referred to *Praobdella guineensis* shows no indication of the velar papilla and consequently cannot be placed in *Myxobdella*. Its resemblance to *Dinobdella* has been pointed out already and until the presence of teeth was discovered I had no hesitation in placing it in that genus along with *D. ferox*. With the presence of teeth determined, this relationship becomes doubtful and it is retained provisionally in *Praobdella* awaiting clearer definition of that genus with knowledge of the anatomy of the genotype.

It will not have escaped notice that while these 3 specimens differ in important respects they resemble one another especially in the speckled color pattern, the large size of the caudal sucker and the small size and obscurity of the posterior pair of eyes.

Hirudo hildebrandti Blanchard. Plate 26, fig. 25; pl. 27, fig. 44; pl. 28, fig. 60.

Hirudo Hildebrandti Blanchard 1897, p. 5.

H. Hildebrandti var. *Carossii* De Qual 1917, p. 7.

H. hildebrandti, Moore 1933, p. 299.

A number of specimens which upon preliminary sorting were referred provisionally to this species were upon dissection determined to be *Limnatis*

oligodonta. This is mentioned as indicative of the uncertainties arising from attempts to characterize leeches from color patterns alone, especially of preserved specimens from which certain pigments have been dissolved. Even the teeth are frequently partly or completely lost, making the determination of their number difficult.

Two certainly belonging here measure 29. x 9. and 32. x 10.5 mm. The larger one has the color pattern exactly as figured by Blanchard, the lip totally lacking a ventral fissure, and 54 straight, conical teeth. The other shows a median and 5 pairs of dark longitudinal lines, the latter due to the concentration of black pigment at both borders of the paramedian and intermediate and the median border of the supramarginal stripes of Blanchard's figure, making 11 in all. The ventral labial fissure is partially developed, and the teeth number 59. The annulation and all other external characters also agree with Blanchard's description except that the smaller specimen has XXVI 1-annulate. The sensillae are small, circular and regular. The jaws of both specimens are short and high and bear a few small papillae near the dentinal ridge. The smaller specimen from Nairobi was partly dissected. The gastric caeca have the typical *Hirudo* form. The terminal ♂ organs (figs. 44, 60) agree closely with De Qual's (1911) figure of *H. medicinalis* except that the epididymi are relatively smaller and the bulbi ejaculatorii relatively larger in the former. Testes not dissected. The ♀ organs also are like De Qual's figure.

Nairobi, Kenya Colony, Dec. 1909, E. A. Mearns, U. S. National Museum, 1; Lake Nabugabo, Kenya Colony, Worthington Coll. 1931, from shore weeds, 1.

Hirudo michaelsoni Augener. Plate 27, fig. 28.

Hirudo sp. Moore 1933, p. 299.

Hirudo michaelsoni Augener 1936, p. 382.

The two specimens taken by Dr. Worthington in Lake Naivasha and referred to by me as *Hirudo* sp. seem undoubtedly to belong to the species since described by Augener. They measure 45. x 10.2 x 3., sucker 4. mm. and 52. x 11.5 x 4.5 mm. The color, annulation, and other external characters agree with Augener's description. The short, prominently elevated jaws bear 46 to 53 teeth and close to the dentigerous ridge a few very small papillae. Gastric caeca are of the typical *Hirudo* form, alternately large and small, and the former little lobed. Terminal ♂ organs closely similar to De Qual's fig. 12 (1911) except that the epididymi are more compact. Testes 10 pairs, XIII/XIV to XXII/XXIII inclusive. The ♀ organs also are similar but the vagina is definitely divided into an expanded, fusiform, thin-walled sac and a cylindrical, muscular duct.

Worthington Coll. 1931, 27(2), Lake Naivasha, Kenya Colony, from weeds, east shore, 2.

Hirudo sjöstedti Johansson. Plate 27, figs. 29, 45; pl. 28, fig. 53.

Hirudo sjöstedti Johansson 1910, p. 29.

A single very dark-colored leech with the pattern obscured by solution of the pigments by the preservative agrees with this species in diagnostic features. It is moderately extended and measures $63 \times 7.3 \times 3.5$ mm. in greatest length, width, and depth, the caudal sucker diameter being 3.9 mm. The ventral labial furrow extends over the posterior $\frac{3}{4}$ of the lip, the anterior part being nearly unfurrowed. Sensillae are very conspicuous on the dark ground as round white dots and nearly all of the 17 pairs of nephropores are easily seen. The surface is perfectly smooth without papillae but with a transverse row of minute sense organs on every annulus. The position of the eyes and gonopores, the annulation and other features of external morphology agree exactly with Johansson's description.

On casual examination the color pattern appears to differ; but, although obscure, good lighting brings out the arrangement of the dorsal stripes exactly as figured by Johansson. The general effect is of a nearly uniform rich golden brown but made up of 7 darker brown stripes, of which the wide median is most distinct, alternating with narrow, more yellowish stripes. The normal contrast between the light and dark stripes has been lost by the action of the killing and preserving fluids on the pigments. The venter is grayish with a few small blackish spots not mentioned by Johansson, and dark submarginal stripes. Miss Ricardo writes that in life the color was dark red.

The jaws appear to be entirely without salivary papillae and on one of the paired jaws removed and mounted, 68 teeth were counted. Except that the atrium is more elongated, the δ organs are like those of *H. medicinalis* (fig. 45). The ejaculatory bulbs and epididymi are very small, the former nearly encircling the latter and the two together having a diameter scarcely exceeding that of the penis-sac. The testes were not dissected. The η organs (fig. 53) are characterized by the relatively large oviducal gland, the long common oviduct and long vaginal duct with a relatively small fusiform vaginal sac.

The specimen was taken by Miss Ricardo in Lake Young, Northern Rhodesia, no exact data being available.

Limnatis nilotica (Savigny). Plate 27, figs. 30, 49; pl. 28, fig. 58.

Bdella nilotica Savigny 1820 (1922), p. 113.

Limnatis nilotica Moquin-Tandon 1826, p. 122.

Limnatis nilotica Blanchard 1894 (for additional synonymy), p. 43.

I have not studied examples of this species from the type locality of Cairo but have dissected and compared specimens from Naples and other circum-Mediterranean localities within the recognized range of the species. These agree closely with 3 lots which are, therefore, referred to this species.

All are in rather poor condition with the colors much faded and the tissues softened. The ventral labial fissure is well-developed. The jaws are small and so macerated that the salivary papillae are seen only with difficulty, while the teeth have largely disintegrated and fallen away. In no case does the number of teeth approach the 100 or more attributed to the species by Blanchard, but runs from 45 to 60, so far as could be counted, which agrees with the Naples specimens referred to above. Because of their macerated condition the teeth are difficult to count and the number may be greater on the examples from Zalingei Swamp. The annulation is in no way different from the published accounts, the papillae are small and the sensillae small circular dots. All have large caudal suckers.

The gastric caeca (fig. 49), which are very favorably partly filled with blood in the Jig Jigam specimen, agree closely with the figures of Moquin-Tandon and De Qual (1911). The reproductive organs (fig. 58) also conform to the accounts of these authors. Both atrium and vagina are much shorter than in *L. oligodonta* and the ductus ejaculatorius differs strikingly in the absence of an enlarged muscular bulb. If enlarged at all the walls are soft and thin like those of the epididymis. The testes were completely dissected in only one (U. S. National Museum No. 55019) in which there were 8 pairs at XIII/XIV to XX/XXI inclusive, and a single reduced one on the right side of XII/XIII, those of the last pair also being smaller.

Although the color is faded many specimens show the 3 pairs of continuous or broken dark dorsal lines, the yellow marginal stripes and the unspotted venter of typical North African examples.

American Museum of Natural History No. 5773, Jig Jigam (Jig Jigga according to Dr. Brown), Abyssinia, Dr. Barnum Brown, Nov. 25, 1920, fresh-water stream in desert, 1 large specimen measuring 96. x 19. x 9. mm., sucker 13.5 mm.; U. S. National Museum No. 55019 (part), Childs Frick Exp. 1911-12, between Abyssinia and British East Africa (Kenya Colony), Edg. A. Mearns, 14; British Museum of Natural History, 1925, Zalingei Swamp, Anglo-Egyptian Sudan, 20.

***Limnatis paluda* (Tennent).**

Haemopsis paludum Tennent 1859 (1861), p. 484.

Limnatis paluda Moore 1927, p. 201.

Two lots of *Limnatis* from Arabia included in the Christy collection agree so fully with the species that I identified as *L. paluda* in the Hirudinea of British India that I have no hesitation in regarding them as conspecific and record them here as extending the range of this species close to the African continent.

The 17 specimens vary in size from 21. x 5. x .8 to 72. x 14. x 5. mm. The head and cephalic sucker are broad and the ventral labial fissure deep and complete. The caudal sucker is large, in most cases nearly equal to the

maximum width of the body. The genital pores occupy the usual position but the ♂ pore is invariably elevated on a prominent conical papilla. The annulation, sensillae and papillae are as described for *L. paluda*, the sensillae being small and circular.

The color on the best preserved examples is nearly uniform rich brown above, paler brown below, with no stripes or spots except the broad yellow marginal stripes and the pale yellowish or white dots of the sensillae and papillae.

The jaws are small and the salivary papillae rather numerous and measuring around .045 mm., the larger type found lower down on the sides of the jaws as in Indian examples of *L. paluda*. Teeth number from 40 to 48 on 3 specimens counted. The gastric caeca are exactly as figured (Plate VIII, fig. 28) and the reproductive organs as described (pp. 204, 205. Moore 1927).

There seems no reason to doubt the specific identity of the Indian and Arabian specimens but whether this species is correctly determined as Tennent's *H. paludum* requires further study.

British Museum of Natural History Coll., Ayun, Arabia, No. 78, Sept. 25, Burton Coll., 16; same, Makullah, Arabia, Dec. 23, 1887, E. L. Phillips Coll., 1.

Limnatis oligodonta Johansson. Plate 27, figs. 31, 32, 41, 42; pl. 28, fig. 59.

Limnatis oligodonta Johansson 1913, p. 23, fig. 9, Tab. 1.

Limnatis oligodonta, Harding 1932, p. 84, figs. 3 & 4.

? *Limnatis nilotica* (Sav.), var., Augener 1930, p. 308.

The many lots and large number of specimens representing this species in the collections indicate that it is the dominant blood-sucking leech throughout central and east Africa, where it replaces *L. nilotica* of the Mediterranean countries and the Valley of the Nile.

Although the pigments are largely faded or destroyed, especially in the Tanganyika material, it is evident that there are two color patterns which grade into each other and which in their typical development are represented fairly well by the figures of Johansson (1913) and Harding (1932) respectively. Both of these are displayed most clearly on young specimens and become more broken and obscure with increase in age and size. Both are simple patterns of alternating light and dark longitudinal stripes but the positions of these are approximately interchanged. This is likely to cause confusion if external characters alone are depended upon for identification, especially as *Hirudo hildebrandti*, as described by Blanchard, also has the pattern figured by Harding. In this pattern the medial dorsal pale field varies somewhat in width but usually includes the paramedian sensillae. It includes also a more or less well-defined median dark brown stripe which again may be a single very narrow line or a double line, or a wider solid stripe occupying more than one-half of the pale field. Besides the median,

there are 3 pairs of dark stripes: very broad paramedians and narrower intermediates, the latter including the intermediate sensillae, and supramarginals including the supramarginal and often the marginal sensillae. These are separated by 2 pairs of narrow yellowish stripes with very narrow, dark borders. On some specimens the dark stripes may be broken toward the ends of the body into spots or rings, the latter giving somewhat the effect of chain stripes and approaching the pattern of *Hirudinaria*. In the Johansson pattern there are typically 4 pairs of dark stripes, the outer paramedians and intermediates being double lines and the inner paramedians and supramarginals single, broader stripes, the latter usually much wider but often broken and irregular; and the median dark stripe is usually absent.

The actual living colors are not noted. According to Johansson the ground color is dark green and the stripes light brown. The former dissolves in alcohol, leaving the now darker brown stripes on a pale yellowish ground. Those of the preserved specimens vary considerably. Marginal stripes clear yellow; venter yellowish, more or less dusky, with irregular submarginal black stripes and often a few scattered spots.

As is usual in the genus, the head and caudal sucker are large as compared with *Hirudo*. The median labial fissure is well marked. The ♂ gonopore is at XI *b5/b6* or slightly within the border of *b5* and the ♀ pore is strictly in the furrow XII *b5/b6* on all of these specimens. The clitellum covers 15 annuli, X *a3* to XIII *b2* inclusive. On most of the best preserved examples the sensillae, particularly toward the caudal end, are distinctly elongated and those of the paramedian pair converge forward at an angle of about 45° as in *Hirudinaria*; on others on which they are difficult to see, no such arrangement can be detected. Neither Johansson nor Harding mention this feature, which, however, was amply verified. Some of the larger specimens are very rough, the large papillae with apical rosettes of conical sense organs numbering 16 to 18 on the dorsum of each annulus of complete somites. Counting the small papillae the number on the dorsum of each annulus may equal 25. Frequently the entire 17 pairs of nephropores are conspicuous on the caudal margin of *b2* from VIII to XXIV inclusive. The annulation agrees substantially with Johansson's description, but 2 should be added to his somite numbers to agree with my notation. Occasional variations occur at the caudal end; e.g., XXIV may have 5 annuli and XXVI 3 annuli on one or both sides.

The jaws are generally long and low with a well-marked dentinal ridge bearing, in cases where they could be counted, about 60 (52-68; average of 18 individuals 58), straight, pointed teeth. The salivary papillae are of two sizes; the smaller ones average .038 mm. and vary from .027 to .054 mm. in diameter, and 8-14 in number, disposed in an irregular row close to the dentinal ridge; and the larger ones average .0754 mm. (.067-.101 mm.) and number 6-9, mostly in a more basal irregular row but partly scattered over the body of the jaw. The scattered ones vary most in size.

No information concerning the internal anatomy of this species has been available hitherto.

Anatomy: The mucous lining of the pharyngeal bulb is arranged in 12 longitudinal folds. The gastric caeca are somewhat puzzling as they undergo much greater change in relative size when filled or empty than in most blood-sucking leeches. There are 2 pairs in each somite. Many of the specimens, apparently as a result of fixation in Perenyi or similar fluid and preservation in formalin, have the tissues swollen and translucent. When illuminated with strong transmitted light the caeca may be seen without dissection. Generally they are empty and the secondary caeca are contracted almost to the vanishing point, whereas the principal caeca are comparatively long and slender. On other specimens even the latter are very greatly reduced so that the stomach appears scarcely more caecate than in *Haemopsis*. When engorged, however, the secondary caeca increase in size proportionally much more than the principal ones. While the latter are always larger, the former become distended to large size, and in the more anterior somites (X to XIII) reach almost as far laterad, resulting in 2 pairs of subequal, lobulated caeca per somite. Proceeding caudal, and conspicuously behind XIII, the principal caeca become increasingly larger relatively to the secondary ones and, bending caudad, lie between them and the lateral body walls.

The reproductive organs (fig. 59) vary greatly in size with their state of development but conform to the type of the genus. Most often the terminal ♂ organs lie to the left, the ♀ to the right of the nerve cord, but the positions may be reversed or more rarely both may lie on the same side. The chief characteristics of the ♂ organs are the large size of the prostate region of the atrium and the open ring-form of the ejaculatory bulb which encloses the small lens-shaped epididymis for fully $\frac{3}{4}$ of its circumference. In a typical mature specimen the parts measure as follows: Penis-sac or atrial stalk 18 mm. long, with a diameter of 1.3 mm. close to the orifice and of 1.5 mm. at the internal end at the beginning of the prostate enlargement, which is ovoid and 5.5 mm. long x 3.2 mm. in diameter. Epididymis 5. x 2.5 x 2.5 mm.; the fusiform ejaculatory bulb enclosing it 7 times as long as its greater diameter. Testes 12 pairs, situated as usual from XIII/XIV to XXIV/XXV. On the translucent specimens from Lake Tanganyika they frequently can be counted without dissection. The ♀ organs have the form characteristic of *Limnatis* in that the common oviduct opens into the end of the vaginal sac, which therefore forms no caecum as in *Hirudinaria*. The retort-shaped ovisacs at XII/XIII measure about 2.5 x 1.5 mm., the sharply bent stem passing into the short oviduct which joins its fellow in a massive albumen gland 3.2 x 2. mm., from the distal end of which passes a long, much folded, unpaired oviduct about 6 times the length of the albumen gland. This opens into the inner end of the vagina, which is long, slender, cylindroid and folded, measuring 13. x 1. mm. and ends at the ♀ gonopore in a globular bulb about 3 mm. in diameter.

Examples referred to this species were studied from the following stations: Christy Coll. Karonga, Nyasaland Protectorate, Lake Nyasa, Aug. 27, 1926, 10; same, Monkey Bay, Aug. 27, 1926, No. 40, 1; same, Bar Lake, 12; Christy Tanganyika Exp., Kigoma, Lake Tanganyika, Oct. 2, No. 408, deep water, 1; same, Kirando, Lake Tanganyika, Oct. 2, No. 414F, seined, 3; same, Kirando, Lake Tanganyika, Oct. 22, No. 418, under stones in water

with *Salifa perspicax*, 1; same, Kapili Bay, Lake Tanganyika, No. 3, No. 453F4 dug from sand with *Salifa elongata*, 1; same, Kirando, Lake Tanganyika, No. 456F, among weeds in shallow water, mottled light brown, 1; same, Oct. 16, No. 589F, under stones, rocky shore, 9; same, Oct. 23-Nov. 11, No. 590F-593F, under stones in shallow water, rocky shore, 24; same, Kala, Lake Tanganyika, Dec., 1; Pitman Coll., Entebbe, Lake Victoria, Uganda, Mar. 14, 1927, 3700 ft., 2; Graham-Worthington Exp., Mwanza, Lake Victoria, Tanganyika Terr., Graham Coll., Sept. 16, 1927, No. 51, bottom sand in native basket trawl, 2; same, Murchison Falls, Victoria Nile, Uganda, from ♀ Hippopotamus, 1; Worthington 1928 Exp., Lake Naivasha, Kenya Colony, Aug. 27, 1928, No. 281 (5), from weedy shore, 1; Worthington 1931 Exp., Lake Naivasha, Kenya Colony, No. 27 (2), from weeds, east shore with *P. stuhlmanni*, 2; same, Lake Baringo, Kenya Colony, No. 132 (2), from stream running into Lake Hannington, Kenya Colony, 3; same, Lake Bunyoni, Uganda, Jan. 27, 1932, No. 705, from weeds along shore, 1; same, Jan. 27, 1932, No. 707 B (4), same, 1; same, L. Nakavali, Uganda, No. 812 (12), from papyrus swamp along shore, 1; Omer-Cooper Exp. Lake Zwai, Suquei River, Abyssinia, Nov. 11, 1926, 1; American Museum of Natural History No. A5773, Abyssinia, B. Brown, 2; Lang-Chapin Congo Exp., Faradje, Belgian Congo, Jan. 1913, No. 550, 551, 552, 50; Mearns Smithsonian Exp., south east end of Lake Naivasha, Kenya Colony, July 16, 1909, U. S. National Museum No. 51304, from ♀ Hippopotamus, 60.

Limnatis africana Blanchard. Plate 27, figs. 33, 46, 47; pl. 28, figs. 57, 61.

Limnatis africana Blanchard 1897, p. 108.

L. africana, De Qual, 1917, p. 8.

There is little to distinguish this species from *L. oligodonta* to be gleaned from Blanchard's original description or the poorly preserved (strongly contracted and usually much faded) material in this collection. Three lots, aggregating 44 specimens, are referred to this species, principally because of agreement with Blanchard's diagnosis in number of teeth, which is constantly greatly than in *L. oligodonta*. Blanchard gives the diagnostic number as 80-90 but his detailed record gives 76-80 for most specimens with one from the French Congo having 84, 85 and 91 on the three jaws. In my material the number counted varies from 78 to 83. They are rather stout, straight and conical, the larger ones near the medial end of the jaw measuring .01 mm. in basal diameter and .021 mm. in exposed length. The large jaw papillae appear to run larger, averaging .079 (.065-.09) mm., and the small marginal ones smaller, .034 (.027-.04) mm., than in *L. oligodonta*. As in *L. oligodonta* and other species there may be a few scattered papillae of intermediate size (fig. 61).

Blanchard refers to the prominence of the sensillae, which are elevated on rounded papillae, but he does not mention that posteriorly they are short linear and arranged partly obliquely, partly transversely to the body axis, nearly as in *Hirudinaria*. Some indication of this arrangement was noticed on some of the best preserved examples of *L. oligodonta* also. The rough dorsal papillae number about 25 on each annulus.

Most of the specimens are faded so that the color pattern is lost or obscure, but on some of the smaller examples it is shown to be longitudinally striped. The median dorsal stripe is obscure or even completely lost, as reported by De Qual also, and the paired stripes are broken, as indicated by Blanchard, especially on the larger specimens. On small ones the pattern approaches somewhat that of the Oriental *Hirudinaria*. There may be a pair of broader paramedian and a narrower intermediate pair of imperfect chain stripes which tend to be interrupted on *a2* and to become united by dark spots on *b6* and *b1* of complete somites. On the supramarginal stripes the pigment tends to leave *a2* and to be concentrated in conspicuous spots on *b2* and *b5*. Consequently, the sensillae bearing annulus *a2* is paler than the others, a feature clearly indicated in Blanchard's figure. The venter is more or less blotched with black spots, most of which are distinctly concentrated in irregular, broad, submarginal and less constant, narrower paramedian tracts. On larger specimens this pattern becomes fragmented and obscured and, by fusion of the spots toward the anterior end, a more linear appearance results. The annulation agrees with that of *L. oligodonta* as described.

While the contracted state of all of the specimens makes exact comparison difficult, no diagnostic differences between the two species were detected in either the digestive tract or the organs of reproduction (fig. 57). Both have the structure described for *L. oligodonta*.

All of the specimens listed below are small or medium, nearly all between the limits of 15. x 4. x 2. mm. and 40. x 8. x 5. mm., only 2 equalling 50. x 12. x 4.5 mm.

U. S. Eclipse Exp. to West Africa, 1889, U. S. National Museum No. 23272, Cunga [Kunga, Angola], W. H. Brown, Jan. 1, 1890, 40; Rhino Camp, Bahr el Jabel, Lado Enclave, Uganda, E. A. Mearns, Jan. 1910, U. S. National Museum Coll., 2; British Museum of Natural History Coll., Gold Coast, 82-6-18, 2; Monrovia, Liberia, Bequaert Coll., 1.

Limnatis obscura, new sp. Plate 27, fig. 34; pl. 28, figs. 54, 55.

Form, as typical of genus in customary resting state, robust, the outline elongated ovate-oblong with the greatest width at the beginning of the posterior $\frac{1}{3}$, tapering very gently to the broadly rounded ends, moderately depressed caudad of the clitellar region, in section narrowly elliptical with the margins broadly rounded in the pregenital region, becoming progres-

sively more terete cephalad. Type and largest specimen measures in mm.: Length 42, to δ pore 7.; widths, buccal 3.2, δ pore 4.5, maximum (XIX-XX) 6.3, anus ca. 3.; depths at same points ca. 2.2, 2.5, 3.2 and 1.5; caudal sucker 4.2. Other specimens measure 19.5 x 3. and 27. x 4.2 mm.

Head somewhat inflated, large and broadly rounded as usual in the genus. Lip very wide, in all of the specimens deflexed into the wide open mouth, strongly arched, smooth above, and, except for the median fissure, unfurrowed ventrally. Buccal ring or posterior lip with a few coarse crenulations. Eyes 5 pairs, very distinct, of moderate and nearly uniform size, with the typical arrangement on annuli 2, 3, 4, 6 and 9 (somites II to VI). Clitellum not apparent externally. Gonopores, δ at XI $b5/b6$, φ XII $b5/b6$, both small, round, orifices slightly within $b5$, the δ on the type only with the tip of the filiform penis projecting for 2.2 mm.; its diameter .2 mm. Nephropores open and easily visible, especially conspicuous on one of the smaller specimens, on the caudal border of $b2$ of all somites from VIII to XXIV inclusive but widely separated, being nearer to the submarginal than the intermediate line. Sensillae small, round dots, quite discernible on most somites in the usual positions on $a2$. Papillae not visible, the skin quite smooth and marked only by many very fine longitudinal wrinkles on each annulus. Anus behind XXVII, followed by one annulus.

Color pattern obscure, the colors probably much altered in preservation. Dorsal ground color nearly uniform dull olive drab, differing somewhat in tone from more yellowish to more dusky on the several specimens. Median field, which is about $\frac{1}{3}$ of the total width, tends to become darker laterally and the much narrower paramedian and intermediate fields or stripes are more yellowish. These 5 fields are separated and bounded by 3 pairs of obscure dark brown or dusky stripes continuous for the entire length, the supramarginal being somewhat wider than the outer paramedian and intermediate. Marginal stripes a clearer grayish yellow. Venter uniform gray, without spots or stripes, on one specimen becoming somewhat dusky submarginally.

Annulation: In no way peculiar, and distinct except on the upper lip. I-III 1-annulate and undefined, bearing the first 2 pairs of eyes. IV 2-annulate, the 1st bearing 3rd eyes and the 2nd ($b3$) separating the 3rd and 4th eyes and contributing to the buccal ring. V 2-annulate, the 1st larger and bearing the 4th pair of eyes, both uniting ventrally as the buccal ring. VI 3-annulate dorsally, all approximately equal and $a2$ bearing the 5th eyes, ventrally $a1$ and $a2$ unite to form the post-buccal ring. VII 3-annulate both dorsally and ventrally $a1 =$ or slightly $< a2 < a3$. VIII 4-annulate, $a1 > a2 = b5 = b6$. IX 5-annulate, $b1 = b2$ slightly $< a2 = b5 = b6$. On the several specimens there is some variation in the size of VII $a3$, VIII $a1$ and IX $b1$, $b2$. X-XXIII 5-annulate, all annuli approximately equal and very regular, but the depth of the furrows differs, especially on the smallest specimen, on which the annuli of complete somites are grouped either 3-2 or 2-1-2. XXIV 4-annulate, $b1 = b2 = a2 < a3$. XXV 3-annulate, $a1 > a2 > a3$. XXVI 2-annulate. XXVII 1-annulate with the furrow $a2/a3$ developed at margins only.

Anatomy: Partial dissection of 2 specimens yields the following anatomical data: Only the smaller salivary papillae, measuring .047 to .053 mm., were seen on the jaws. Teeth mostly broken, the number counted

varying from 68 to 80 which may be somewhat less than the actual number. On both specimens both atrium and vagina lie on the left side of the nerve cord. The description is chiefly from the type specimen in which they are larger and more mature (figs. 54, 55). Testes not dissected, vas deferens as usual, continuous with the antero-median limb of the epididymis. Epididymis small, about $\frac{1}{2}$ the diameter of the prostate, very compact, consisting of the usual 2 limbs, the antero-median of a narrower and postero-lateral limb of a coarser tube, both closely and intricately folded. From the posterior end of the latter arises the slender fusiform ejaculatory bulb which when undisturbed encloses the epididymis closely for about $\frac{2}{3}$ of its periphery. In the figure both epididymes and vasa deferentia have been displaced to show the parts better. From the narrow end of the bulbs short capillary ejaculatory ducts pass to the prostate head of the atrium. Atrium remarkably short, its entire length in the type being 2.8 mm. and in the smaller specimen 2.2 mm., of which the enlarged prostate forms about $\frac{1}{3}$; penis sac cylindrical, about 5 or 6 times as long as the diameter, slightly enlarged at the orifice. Prostate globose, the diameter about $2\frac{1}{2}$ times that of the penis-sac, with a thick white cap of prostate glands which extend ectad over the ejaculatory ducts as a pair of slender pointed lobes. ♀ organs similarly proportioned. Ovisacs in the usual position at XII/XIII, the paired oviducts having a length of only about twice the diameter of the ovisacs, with the right one of both specimens passing beneath the nerve cord. They unite in a common oviduct within a large pyriform oviducal gland, which is at least twice the diameter of the ovisacs. Common oviduct about as long as the vagina, little tortuous but varying somewhat in this respect and in diameter in the 2 dissections, opening into the summit of the vaginal sac without any caecal diverticulum. Vaginal sac fusiform, about as long as the penial sac and at the widest part slightly exceeding it in diameter, in the type with a short duct or stalk leading to the external orifice, in the other dissection nearly sessile.

"Naukhluft Mts. above Bullsport, S. Africa, 1500 m., Dr. K. Jordan, Dec. 5, 1933." Type (largest specimen) in British Museum of Natural History and 3 others.

This species differs from all other members of the genus that I have dissected in the proportions of the reproductive organs. These, combined with the number of teeth, the color pattern and the sensillae, diagnose the species. But it is quite possible that it may be one of the numerous inadequately described species of African "*Hirudo*" recently created. The color pattern resembles that of *Hirudo parodi* Sciacchitano ('37) but the dark stripes show no traces of doubling as in that species.

Limnatis fenestrata, new sp. Plate 27, figs. 35, 36, 43, 48; pl. 28, fig. 56. .

The moderately contracted and flattened type (de Schauensee Coll.) measures in mm.: Length 23., to ♂ pore 6.6; widths, buccal, 3.2, ♂ 6.8, maximum (middle) 8.3, anus ca. 3.5; depths at same points respectively 2.8, 3., 2.8, 2.; caudal sucker much contracted 3. The largest and a more extended example (Ricardo No. 252/7) measures: Length 61., ♂ 11.5; widths 3.6, 10., 12.2, 3., depths 3., 4.5, 7., 1.3; sucker 5.5 mm. Type and

one other example relatively broad and flat except in the preclitellar region which is rounded and sharply narrower. Other 3 specimens more extended and much less depressed, with the dorsum much more arched and the venter flat. As on the type the greatest width of 2 is far forward at about XVI, or on the largest specimen at the caudal border of the clitellum, from which point the outline tapers both ways to nearly equal, relatively narrow ends. Lip rather narrow, rounded, with a well-marked median ventral fissure reaching anterior margin, and 2 or 3 shallower furrows on each side. Eyes 5 pairs, arranged as usual on somites II to VI but difficult to see on account of the heavy pigmentation of this region. Clitellum ill-defined externally though enlarged by the development of a thick layer of glands internally, distinguished chiefly by a somewhat paler dorsal color, greater smoothness of the surface and slight enlargement of the annuli on the largest specimen only, on which it appears to include 17 annuli from X *b5* to XIII *b6* inclusive, but the last 2 less definite. Gonopores small on all, the ♂ larger and slightly extended laterally, both definitely in the furrows, the ♂ at XI *b5/b6*, the ♀ at XII *b5/b6*. Nephropores close to caudal border of *b2* in the intermediate line of all somites from VIII to XXIV inclusive. Anus behind XXVII, no post-anal annulus. Sensillae of the number and distribution characteristic of the genus, caudally the dorsal resemble those of *Hirudinaria* and differ from typical *Limnatis* in being short linear, elevated on large elliptical, translucent papillae, the paramedian and intermediate inclined to the median line at angles approximating 45° and the supra-marginal and marginal nearly transverse; paramedians lie just within the borders of the median pale brown stripe, intermediates and supramarginals in the corresponding black stripes and marginals in the dorsal part of the yellow marginal stripe; ventral sensillae smaller, inconspicuous and easily confused with the non-metameric sense organs. Dorsum roughened by 20-25 small non-metameric papillae on each annulus, each bearing at the summit one or a cluster of several small conical sense organs; ventral papillae similar but smaller and like the sensillae very difficult to see on the whitish background.

Annulation: Somites I, including the minute prostomium, II, and III very short and crowded into the small lip, not distinguishable as separate annuli but bearing the first 2 pairs of eyes; IV 2-annulate the 1st (*a1 a2*) bearing the 3rd pair of eyes and the 2nd (*a3*) united laterally with V *a1* to merge into the buccal ring and form the lateral buccal lobes; V 2-annulate dorsally, the first slightly larger and bearing the 4th pair of eyes, ventrally united with IV *a3* to form the buccal ring; VI 3-annulate dorsally, *a2* slightly < *a1* slightly < *a3*, eye 5 on *a2*, *a1* and *a2* united laterally and ventrally as post-buccal ring, *a3* distinct all around; VII 3-annulate dorsally and ventrally, *a1* = *a2* slightly < *a3*; VIII 4-annulate, *a1* > *a2* slightly > *b5* = *b6*, first nephropore on *a1*; IX-XXIII 5-annulate, all equal or *a2* slightly larger, *b1* with *b2* and *b5* with *b6* somewhat more closely united; XXIV 4-annulate *b1* = *b2* slightly < *a2* slightly < *a3*; XXV 3-annulate, *a1* > *a2* > *a3*; XXVI 2-annulate, (*a1 a2*) > *a3*; XXVII 1-annulate. No post-anal annulus except in 1 specimen which has XXVII reduced.

Color: Miss Ricardo writes that in life these leeches (specifically 15(1)) were dark red. This was due chiefly to the blood in the highly vascular integument and has completely faded in the preserved specimens, the ground

color of which varies from pale yellow through gamboge to reddish brown, somewhat paler ventrally. No median dark stripe, though some specimens have the narrow median field sharply defined and narrowly bordered by yellow. When best preserved 3 pairs of dorsal black stripes are sharply defined, the paramedians broadest, supramarginals next, and intermediates the narrowest. All 3 extend for the entire length from lip to caudal sucker and while retaining a very regular general width are much cut into and punctated by numerous round pale yellow spots giving a conspicuously fenestrated pattern, something like a section of wood that has been excavated by termites or carpenter ants. The 3 stripes of each side are united into an irregular reticulum by bars of the same structure on annuli *b6* and *b1*, especially well developed on somites of the caudal half. Supramarginal stripes especially strongly developed on *b2* and *b5* as deeply pigmented quadrilateral spots joined by smaller spots. The result is that the sensory annuli (*a2*) appear somewhat lighter colored than the others. On both the head and the caudal sucker the 3 stripes on each side coalesce more or less completely, leaving a broad median field of the paler ground color flanked by dark pigment spots. On the caudal sucker the pigment is concentrated at the margins. Ventral ground color similar but paler and usually more grayish with a pattern of black pigment of the same type as the dorsal pattern but constituted of 2 pairs only (paramedian and submarginal) of longitudinal black stripes. The submarginals are usually continuous for the entire length but the paramedians are usually more or less broken, especially toward the head end, into irregular spots. Irregular cross bars connect the stripes of each side on *b5* and less frequently on *b6* and *b1* and occasionally even connect the paramedian stripes across the median ventral field. Ventral surface of caudal sucker usually heavily blotched and the posterior half often nearly solidly black. Marginal stripes more or less clear yellow without pigment spots. The color variations noted concern the ground color, tendency of the dorsal pattern to break up or become obscure, and the degree of blotching of the ventral surface, 1 specimen having only a few spots representing the paramedian stripes and the submarginals brown, including a few black spots. One specimen in which the black pigment is faded or washed out has the dorsal pattern obscure. On superficial examination there appear to be 9 dark dorsal stripes separated by 8 yellow lines. The 3 extra dark stripes are due to the median field appearing to be almost as dark as the faded black stripes and to the apparent splitting of the paramedian stripes into 2. But a careful study shows the presence of the characteristic pattern.

Anatomy: Jaws of type and 2 others dissected and mounted and on all seen through the mouth; large and prominent with strong denticulous ridge bearing from 72 to 78 teeth, the largest of which measure about .01 mm. in diameter and .021 mm. in exposed length; salivary papillae about 20 on each side of each jaw, about 8 larger ones measuring about 0.54 (.04 to .067) mm. scattered about midway on the sides, and 10 to 12 smaller ones measuring .018 to .036 mm. mostly in a fairly regular row near the denticulous ridge. Gastric caeca not dissected. Reproductive organs (fig. 56) dissected on the type and the larger example from Mansya River (42/5). In both cases all parts of the organs are large, functioning, and white or nearly white. In the type the atrium lies on the left, the vagina on the right, in the paratype

both lie on the right side of the nerve cord. Testes not dissected beyond the 1st pair at XIII/XIV. Epididymis relatively small, its diameter little greater than the slender penis-sac, having the usual form of 2 limbs continuous on the side of the bulb, the posterior larger and formed of a relatively few folds of a larger tube opening at the free end into the ejaculatory bulb, the anterior of a more intricately folded tube of smaller diameter, which receives the vas deferens at its antero-medial or free end. Ejaculatory bulb of the usual sub-fusiform shape with the greatest diameter of about .75 mm. near the caudal end, from which it tapers very gradually forward to its continuation as the ejaculatory duct, its length about 3. mm., strongly curved and enclosing the epididymis on the lateral side for about $\frac{2}{3}$ of its circumference. Ducti ejaculatorii delicate white tubes which connect the small end of the bulbi with each side of the lower end of the prostate, their length being about $\frac{1}{2}$ that of the atrium or when one passes beneath the nerve cord slightly more. Atrium much elongated, about 15 mm. in each of the specimens dissected, of which the prostate makes about $\frac{1}{3}$. Penis-sac much elongated, cylindroid, nearly uniformly about 2 mm. in diameter but somewhat enlarged to form a bursa at the external orifice, folded longitudinally 3 or 4 times, the 1st at the point where it joins the prostate enlargement, dead white in color and firm in texture owing to the thick layers of longitudinal and circular muscles. Prostate a conspicuous ovate head, sharply bent on the penis sac and measuring about 3 mm. in length and 2.3 in greatest diameter but in both dissections somewhat flattened. Prostate glands slightly yellowish, forming a cap covering the prostate head of the atrium and extending a short distance down the penis-sac on each side as a flattened lobe. Ovisacs in the usual position on the floor of the body at XII/XIII, globoid, about the same diameter as the penis-sac. Paired oviducts unequal in length, the one that passes beneath the nerve cord being about twice as long as the other, which it joins in a large (about 2. x 1.5 mm.) soft white albumen gland from which passes the somewhat larger common oviduct to continue regularly into the extreme end of the vaginal sac. Entire vagina about as long as the penis-sac but in both dissections much more slender; sac and duct differentiated, but the former, which is a little more than $\frac{1}{2}$ as long and about twice the diameter of the duct, is a simple fusiform enlargement which tapers on the one hand into the common oviduct and on the other into the vaginal duct, the latter being of nearly uniform diameter except for the bursal enlargement at the ectal end.

Six specimens in all were available: Botletle River near Lake Ngami, Bechuanaland, R. M. de Schauensee, 1931, type, Coll. Academy of Natural Sciences of Philadelphia, No. 4172 and 1 paratype; Northern Rhodesia, Miss C. K. Ricardo, British Museum of Natural History, No. 15(1), "Lake Young, Shiwa Ngandu, mouth of Mansya Riv.," 1 with *P. stuhlmanni*; same, (42/5), Mansya River, southeast side of Lake Mansya, Aug. 22, 1936, 2 with *P. pulchra*; same, 252(7), no exact locality, bought from a native and taken from the fish called "bwelele".

Miss Ricardo writes that this species was "exceedingly common in Lake Young, where it was often seen swimming among the water plants, and in

the swampy pools among the grass at the edge of the lake. One could not stand in the water for more than a moment without collecting several of them on one's ankles. Very dark red in color."

This species differs from typical *Limnatis* and resembles *Hirudinaria* in the form of the sensillae and in some respects in the color pattern but it differs sharply from the latter and resembles the former in the structure of the female genitalia. If I am correct in the identification of *L. africana* Blanchard this species is related but the color pattern is closer to the *Hirudinaria* type.

ERPOBDELLIDAE

Saiia perspicax Blanchard. Plate 27, fig. 38.

Salia perspicax Blanchard 1897, p. 7.

S. perspicax Augener 1936, p. 385.

Not *S. perspicax* Johansson, 1909, p. 521.

Judging from the number of specimens brought back, especially by the Christy and Worthington Expeditions, this species must be exceedingly abundant in the Rift Valley Lake Region. This is the type locality, Blanchard's material having come from Kiriwia, near Lakes Albert and Edward. In all, the collections include 312 specimens of all sizes, from 6.7 x 1.4 to 48. x 4. mm., with a few more extended specimens at the lower and upper length limits of less width or greater length respectively. Blanchard's largest example measured 26. x 3. mm. and Augener's 29. mm. in length. Most of the material was fairly well preserved except that some of the larger lots had been fixed with a killing solution that dissolved most of the pigment, including that of the eyes, and caused partial histolysis of the tissues, leaving the specimens so transparent that the external characteristics were obscured and some features destroyed.

External characteristics in general agree closely with Blanchard's description. Except for differences in terminology and in interpretation of a few of the obscure terminal somites the annulation agrees with his figure. The arrangement of the eyes, while conforming to the typical plan, is subject to considerable variation and in one respect departs from Blanchard's description and figure. Blanchard shows 2 pairs of eyes (a larger paramedian and a smaller intermediate on the dorsum of his 3rd annulus). While an outer eye occurs rarely on one or both sides, the usual condition is a single pair of large cephalic eyes only on somite IV, as figured by Johansson for his *Trematobdella perspicax*. The post-cephalic, or accessory eyes are strictly lateral, very deeply sunk beneath the surface and, unless the black pigment is dissolved out, as it is in most of these specimens, very conspicuous through the transparent tissues. The typical disposition is, as figured by Blanchard, of 6 pairs on the sensory annulus (*a2*) of somites V to X. Those of the 1st pair are smaller; the others may be uniformly

larger or they may increase in diameter cephalo-caudad but frequently one or both of those of the 6th pair may be much smaller. One or both of the 1st pair may be absent and the same is more rarely the case with the 6th pair. On the other hand additional eye-spots of similar appearance occur rarely as far caudad as somite XIII and in 2 specimens they were detected on most of the post-clitellar somites.

As pointed out by both Johansson (1913, p. 39) and Augener (1936, p. 387), Blanchard completely overlooked the pharyngeal stylets. He figures (Pl. IV, fig. 10) the cephalic end of the pharynx with the terminations of the 3 muscular ridges (homologues of jaws of Hirudidae) and the alternating pseudognaths (homologues of velar lobes of Hirudidae) without trace of stylets. Stout fusiform or cone-shaped stylets are present on all specimens studied. Usually there are 2 of nearly or quite equal size and both functional on each jaw, disposed in tandem in the median plane on the dorsal jaw but somewhat obliquely on the paired jaws. In some cases the anterior stylet only appears to be functional, the posterior one smaller and in reserve; occasionally only one is present.

Nothing has been published dealing directly with the reproductive organs of this species, though Johansson (1914) has given a brief account of those of *Trematobdella*. Numerous examples studied by me as dissections, unstained or stained whole mounts and serial sections, agree closely with Johansson's description. No one of the specimens seems to have been in a state of maximum reproductive activity. Mature spermatozoa or ova were rarely found, but the testes sacs and ovisacs contain large numbers of gametogonia and gametocytes. Many specimens have a well-defined clitellum extending over 15 to 15½ annuli from X b5 to XIII a2 or ½ XIII b5, but in no case is the clitellum thickened and prominent as is customary on fully mature individuals of this family. A noteworthy condition is that the large individuals are frequently less developed sexually than the small ones. The atrium is of the *Dina* type with small globoid median sac opening into a bursa which is often partly everted as a ring around the ♂ pore. The ectal or stalk end of the atrium projects freely into the cavity of the ♂ genital bursa as a short, conical, median penial papilla which was never found protruding from the gonopore and which appears to be incapable of extension into a filiform penis as in *S. elongata*. The horns arise from its summit on each side of the nerve cord and diverge sharply nearly horizontally caudo-laterad, passing into the ejaculatory ducts opposite ganglion XIII with no marked constriction or change in diameter. The sperm ducts are simply wavy to about ganglion XIV where they become greatly folded and tortuous but continue nearly uniformly of the diameter of the atrial horns without any definitely enlarged ejaculatory bulb or sperm vesicles. More mature individuals would probably show enlargement. At the caudal

end of XIII the duct abruptly contracts to the capillary vas deferens, along which the testes are arranged from ganglion XVII to the caudal end of somite XXIII. Occasionally on one side they fall a little short of these limits. The number of testicular sacs on each side varies from 34 to 42, the higher numbers predominating, with the average of 20 examples of various sizes counted 39, or 6 on each side of each of the $6\frac{1}{2}$ somites. There appears to be no increase in number with size of the leeches. The ♀ organs consist of the usual short, simple vagina which passes from the ♀ orifice to the nerve cord, beneath which it bifurcates into the 2 simple thin-walled ovisacs which then extend obliquely laterad to the sperm ducts, ventrad to which they continue nearly or quite to the level of ganglion XIV, never in this material further. At the blind end they may taper or become bulbous. No spermatophores were observed.

A careful search for the gastropore was made, almost every specimen being examined under a binocular microscope in good light, others being stained and mounted entire or as sections. Not the slightest trace of it was found so that its absence from this material is certain.

These leeches inhabit chiefly the shallow waters of rocky or shingly shores of the lakes where they are found concealed under stones. A few were taken in small detached pools. Stomach contents show that the food consists of insect larvae, small oligochaetes and other small invertebrates.

Egg-capsules were taken attached to the under surface of stones, associated with the leeches at several localities. They have the flattened, ellipsoidal form characteristic of the family and measure from 4.5 to 5. x 3. to 3.5 mm. All examined were empty or contained only 2 or 3 young about ready to leave.

As in many other small species of the family, the color in life is probably reddish, and traces of the red blood color remain in some of the formalin-preserved specimens. In all of those in which the pigment has not been dissolved out, and more especially in the larger individuals, the dorsum is more or less thickly spotted with round black or dusky dots which are usually absent from a median stripe and most numerous in the paramedian fields.

The collections include examples from the following stations: Christy Tanganyika Exp., Pask Coll., Kigoma, Lake Tanganyika, No. 399, Sept. 21, 1926, under stones in shallow water on rocky shore, 3; same, 422, Sept. 30, 25; same, 587, Sept. 27, 55; same, Kirando, Lake Tanganyika, 409F, Oct. 14, 57; same, 415, Oct. 22, 24; same, 418, 45; same, 439F, Oct. 23, 9; same, 445, Oct. 25, under stones 50 yds. from shore, 14; same, Kapila, 450, Oct. 28, under stones on muddy shore, 2, with *Barbronia delicata*; Graham Coll., Bubembe Is. Lake Victoria, Sta. 77, Sept. 29, 1927, 3; same, Bumbirch Is., Sta. 41, Sept. 10, 1927, 1; Worthington 1928 Coll., Lake Albert, No.

84 (1), near Buluka, Apr. 16, 1928, under stones in surf, 14; same, Kibero, Lake Albert, Uganda, 123A (1), Apr. 27, 2; Worthington 1931 Coll., Lake Baringo, Kenya Colony, shore of rocky island under stones, 127(8), with 3 *B. tricarinata*, 10; same, Lake Edward, Uganda, pools near north shore, 520 (2), with *B. tricarinata* and *P. jaegerskioldi*, 3; same, stony southwest shore, Belgian Congo, 557, 13; same, northwest shore, Belgian Congo, 570 (1), 13; American Museum of Natural History Coll., Barnum Brown, near Harrar, Abyssinia, No. A5773, 1; J. Bequaert Coll., Kisenye, north shore Lake Kivu, Belgian Congo, 3. Egg cases also were taken at Christy Nos. 403, 410, 490E and Worthington 1931, No. 557, attached to stones.

The status of *Trematobdella* Johansson and *Herpobdelloidea* Kaburaki in relation to *Salifa* remains to be considered. Johansson (1909) originally described his leech as *Salifa perspicax* Blanchard. Later he compared examples of Blanchard's material on which he found no dorsal gut pore opening externally at XV/XVI and on the basis of this and other departures from Blanchard's diagnosis of *Salifa* established the genus *Trematobdella* for his species (1913, 14). In 1927 I showed the generic union of *Nematobdella* Kaburaki with *Herpobdelloidea* Kaburaki, and doubtfully of these with *Salifa*, and suggested their close relationship with *Trematobdella*. This last was on the assumption that Blanchard, having overlooked in his dissection and drawing of the pharynx the rather conspicuous stylets, might have done the same for the gut pore. Augener in his recent paper (1936) goes farther, not only definitely accepting the synonymy of the four genera but also that of the type species of all but *Herpobdelloidea* in the original restricted sense of Kaburaki. While the discovery of the pharyngeal stylets and the character of the reproductive organs definitely establish the synonymy of *Nematobdella* and *Herpobdelloidea* with *Salifa*, the species *H. indica* is quite distinct from *S. perspicax*. *Trematobdella*, while almost specifically identical with *Salifa* in every other respect, stands sharply apart in the possession of a dorsal gut pore. Johansson has demonstrated the verity of this character in the most complete and convincing manner and the canal is very conspicuous in a small example (13 mm. long) kindly sent to me by Dr. Johansson several years ago. In the Oriental genus *Gastrostomabdella* (Moore 1929, p. 271) it has been demonstrated that the gut pore is absent in the young, develops gradually and is fully open and functional only at maturity. The present collections include numerous examples of *Salifa* of all sizes from individuals newly hatched to fully grown ones much larger than any of Johansson's specimens of *Trematobdella* and 3 times as long as the one examined by me. It seems clear, therefore, that the absence of the pore in *Salifa* cannot be explained by the youth of the specimens. There remains the doubtful hypothesis that the gut pore may be seasonal in development, appearing and then being closed and obliterated.

Some slight suggestion of this arises from the fact that Johansson's specimens of *Trematobdella* were taken in February and March while nearly all of the *Salifa* material studied by me was collected in September and October. However, there is one lot (Worthington 84, 1) of 14 excellently preserved specimens taken in April and measuring from 6.7 x 1.4 mm. to 18 x 3.5 mm., no one of which shows the slightest indication of a gut pore. It seems, therefore, that Blanchard correctly omitted the presence of a gastropore from his diagnosis of *Salifa* and, notwithstanding the remarkable specific resemblance between the two, that Johansson was justified in separating *Trematobdella* especially for its possession of that structure. At least that is the conclusion justified by our present knowledge. In addition it might be pointed out that this conclusion is supported by some collateral evidence. In *Trematobdella* Johansson found about 55 testicular sacs on each side distributed through somites XVIII to XXIII (that is XX to XXV in my notation) while in *Salifa* I find about 40 from the middle of XVII to the end of XXIII inclusive. In the former case there are 9 pairs per somite, in the latter only 6 or sometimes less. Johansson figures the stylets of *Trematobdella* as constricted between the base and the point. In *Salifa* no such constriction was evident to me.

Salifa elongata, new sp. Plate 27, fig. 37.

The longest example originally measured in mm.: ⁴ Length 75, to δ pore 10.5; widths, buccal 1., at δ pore 1.9, maximum at beginning of caudal third 2.9, at anus 2.2; depths, buccal 1, δ 1.7, at point of maximum width 1.8, anus 1.2; caudal sucker 1.8 x 2.2 mm. The type and other specimens are somewhat smaller but similarly proportioned. A smaller contracted specimen measures 32. x 3 mm. and has the proportions of an extended *Dina fervida*.

Form extremely slender, elongated and cel-like, anteriorly terete and pointed, posteriorly slightly widened and flattened, as indicated by the measurements, and with a small sucker. Consistency firm and hard, surface very smooth and slippery.

Head remarkably prolonged for an erpobdellid, the lip spoon- or scoop-shaped, semi-elliptical in frontal outline; its ventral margin straight, nearly at right angles to the plane of the buccal ring, with a well-defined thickened rim and small cavity; mouth very small; dorsal surface arched from side to side, the profile in the posterior half gently curved, the anterior half strongly curved ventrad so that the frontal border is nearly at right angles to the dorsal. More contracted specimens have the head relatively shorter but of

⁴ This specimen, originally preserved in formalin, was reexamined in 1937 after having been in alcohol for several years and was found to have undergone extraordinary shrinkage, the length having become 44 mm. and the distance between the end of the lip and the male pore 7. mm. Other measurements of this and other specimens were correspondingly reduced. The surface has become wrinkled, and the tertiary inter-annular furrows are deeper than when first studied.

the same peculiar form. No eyes are visible on any of the entire specimens; but sections show them to be arranged as in *S. perspicax*, a pair of larger dorsal ones on IV, one or two pairs of lateral eyes on V and a pair of small, deep, lateral accessory eyes on VI to X.

No thickened clitellum. ♂ gonopore a small, simple orifice at XII *b1/b2*, on some specimens on a low papilla due to prominence of the atrium, and the ♀ gonopore a scarcely visible minute orifice at XIII *b1/b2*, separated by a full somite of 5 or 10 annuli according to the method of counting. On most specimens there is no indication of eversion of the ♂ bursa or protrusion of the atrium but in 2 examples a small cylindrical papilla lies in the opening and from the orifice of 2 others projects a slender, somewhat twisted, penial filament about 1.5 mm. long and .2 mm. in diameter in one and 2 x .15 mm. in the other, nearly uniform in diameter but slightly tapering from base to tip, terete and perfectly smooth in both. Nephropores are clearly visible on most of the somites, especially of the largest specimen, the 1st on the caudal margin of VIII *a1* and the others in a corresponding position on *b2* to the 17th on somite XXIV. On one specimen a small opaque whitish spot on the floor of the stomach at XIV/XV was thought to be possibly the inner end of a gastropore situated as in *Trematobdella* but it could not be traced to the surface and nothing similar appears in other specimens either entire or sectioned. Anus unusually far forward, a small orifice with raised and furrowed borders in the furrow XXV/XXVI. Caudal sucker small, elliptical, slightly longer than wide.

No definite papillae or elevated sensillae are present but a row of minute sense organs runs across each annulus. The surface is very smooth, shiny and slippery. A superficial vascular net-work filled with reddish blood is very conspicuous anteriorly, especially in the pharyngeal region, but absent or not evident in the posterior third. In the preclitellar region the reticulum is fine and regular and on the margins tends to form a pair of lateral vessels; on the clitellum the meshes are larger and fewer and behind the clitellum the network is reduced principally to transverse vessels, usually one to each tertiary annulus. The wrinkles referred to in the foot note on p. 351, mostly follow the course of these vessels.

Color: Color in life probably reddish due to the blood showing through the translucent tissues. No pigment is present in any of the specimens and beside the red of the blood, which remains in part, the tinting differs, probably due to different methods of fixation. One specimen is pale brownish yellow, another is gray and the rest have the body walls and pharynx transparent and colorless (except for blood) and the stomach and intestine a pale cream color with traces of brown due to botrioidal tissue.

Annulation: Difficult to see on account of transparency of the tissues and absence of pigment, together with the shallowness of the furrows, especially at the cephalic region. On the other hand the ganglia of the ventral chain and the nephropores are definite and conspicuous indicators of the position of the somites. The constitution of somites I to VI, constituting the head region, could not be made out. VII 2-annulate, the 1st annulus (*a1* + *a2*) twice the length of the 2nd and including the 1st free ganglion. VIII 3-annulate (*a2* ca $\frac{1}{2}$ *a1* < *a3* (*b5* *b6*)), 1st nephropores on *a1*. IX 4-annulate, *a1* (*b1* *b2*) much > *a2* = *b5* = *b6*. X 5-annulate, *b1* = *b2* < *a2* = *b5* < *b6*. XI 5-annulate, *b1* = *b2* = *a2* slightly < *b5* < *b6*. XII to

XIV may be interpreted as of either 5 or 10 annuli, the tertiary furrows being quite evident and nearly as deep as the secondary, but in profile views the 5 annuli stand out more prominently than their subdivisions. On all of these the 5th annulus ($b6$) is distinctly larger than the others, which are approximately equal. Nephropores are on the caudal margin of $b2$ and the gonopores at XII $b1/b2$ and XIII $b1/b2$ respectively. XV to XXIII on the type and most of the other specimens are clearly 10-annulate, with all tertiary subdivisions ($c1 - c2$ and $c9 - c12$) of the primary annuli $a1$ and $a3$ and secondary divisions ($b3$ and $b4$), of $a2$. With the exception of the 3rd, 4th ($c3$ and $c4$), 7th ($c9$) and 9th ($c11$) which are somewhat longer, all annuli are approximately equal. Last (17th) nephropores on XXIII $c4$. XXIV 5-annulate with $a2$ much $< a3$ ($b5 + b6$) = $a1$ ($b1 + b2$) and the tertiary furrows still visible at the margins. XXV 3-annulate, $a1 > a2 > a3$. XXVI 2-annulate, and XXVII 1-annulate, are post-anal.

Anatomy: Owing to their transparency much of the internal anatomy was seen on entire specimens, these observations being verified and extended by the study of sections. Their extreme elongation is evidenced by the following data relating to the spacing of the nerve ganglia of mounted specimens in comparison with related species. The post-oral (sub-oesophageal) ganglionic mass composed of III to VI lies in VI, the others are in the neural annuli of their respective segments. Ganglion VII is separated from VI by less than its own length and the following numbers represent the number of times its own length that each ganglion is separated from the preceding one: VIII 3½, IX 6, X 9, XI 10, XII-XIV 11 to 12, XV to XXIII about 14, XXIV and XXV about 10, XXVI from XXV by about its own length and from XXVII, representing the beginning of the caudal mass, by much less. In the close association of ganglion VII with the sub-oesophageal mass and of XV and XXVI with the caudal mass this species resembles *Trematobdella*.

The dental stylets of some specimens are dissolved but the remaining sockets show their position. There are 2 placed in tandem at the cephalic end (jaw) of each of the 3 muscular ridges about midway between the supra-oesophageal ganglion and the 3 triangular velar lobes (paragnaths) which are well developed. On the dorsal jaw the 2 stylets are exactly in the median line; on the paired jaws they are slightly oblique. The pharynx is long, reaching to somite XV, and very powerfully muscular. In the absence of dissections it is very difficult to determine from the single series of sagittal sections whether the pharyngeal ridges are straight (enthylaematous) or twisted through 60° (strepsilaematous). They appear, however, to be the latter with the median ridge dorsal at the anterior end and ventral for most of the length of the pharynx, which would be in harmony with the presence of stylets and large paragnaths. There is no distinct oesophagus, the pharynx passing into the stomach without any definite valves and the muscular ridges of the pharynx being continuous with paired dorsal and median ventral longitudinal epithelial folds of the stomach. Each of these folds then splits into 3 and between each 2 of these groups a smaller fold appears, making in all 12 deep plications. Farther back this regular arrangement is lost and all folds become irregular and deeper. The stomach continues as a somewhat chambered spacious tube to the end of XX where it is separated from the intestine by a strong sphincter muscle

and valve. The first part of the intestine is a narrow tube with simply folded mucous lining and a heavy muscular coat but it becomes again expanded with complexly folded lining and then tapers by a short rectum to the anus.

The reproductive organs are in general similar to those of *Saliba perspicax*. On the specimen sectioned the small testes sacs form a single row of 41 on one side and 42 on the other, reaching from the ganglion of XVII to the end of XXI or 7 to 8 pairs per somite. On a specimen mounted entire they appear to continue to the end of XXIII and to number rather doubtfully about 55 pairs. The very delicate capillary vasa deferentia lie on the ventral longitudinal muscles ventral to the testes. At the anterior end of the series of testes in XVII they bend dorsad and become abruptly enlarged into the spermatid vesicles. The latter have thick muscular and epithelial walls and expanded lumina filled with sperm. Even in this greatly extended worm they are so much folded that from 5 to 9 cuts of the tube appear in each section on each side between the stomach and the nephridia. The tubes increase in diameter gradually until in the preneural part of somite XVI they are about twice the diameter of the posterior end in XVII and the folds are more open so that they appear fewer times in sections. Finally in XV, by further increase in diameter, due chiefly to thickening of the circular muscle layer, they become the ejaculatory ducts, which are simple, only slightly flexuous and taper anteriorly to join the ends of the atrial cornua. Atrium a small pyriform, thick-walled, muscular bulb, from the broad roof of which the simply curved cornua arise, one on each side, and without extending anterior to the atrium, curve caudo-laterad to be joined by the ejaculatory ducts. The tapered ventral end of the atrium projects into the cavity of the ♂ bursa as a small muscular penial papilla. It is the extension of this which forms the short projecting penis described before. It is neither an introvert, as in most species of Hirudidae, nor is it an introverted atrial cornu as was at first supposed. Sections show it to be the elongated papillae, with both atrial cornua in their normal position. The ♀ organs consist of a short slender vagina rising obliquely caudad from the ♀ pore to the nerve cord immediately anterior to ganglion XIII where it bifurcates into right and left ovisacs which diverge and become slightly bulbous at the closed ends, but in these specimens do not extend beyond somite XIII.

All 6 examples of this species came from Kirando on Lake Tanganyika, some of them dredged from the sandy bottom in depths to as much as 30 ft., others dug from the sandy shore. It is evidently a burrower for which its elongated form, pointed head, smooth, slippery surface, muscularity and firm consistency, like *Amphioxus* or a young eel, admirably fit it.

Christy Tanganyika Exp., Kirando, Lake Tanganyika, Feb. 11, 1926, No. 452F, dredged from sandy bottom, 1; same No. 453 F4, dug from sand, Kapili Bay, Lake Tanganyika, Nov. 3, 1926, 3; same, No. 454F., dredged in 5-30 ft., sandy bottom, Mar. 11, 1926, type and 1 other. Type in British Museum of Natural History.

Barbronia delicata, new sp. Plate 28, fig. 62.

A very dainty little leech with the cephalic end slender and tapering regularly in the preclitellar region to the small head, the middle $\frac{2}{3}$ or more of nearly uniform width with the sides approximately parallel, and the caudal $\frac{1}{3}$ tapering in a gentle curve to the sucker peduncle, moderately flattened throughout most of the middle region, much more so than in the 2 species of *Salifa*.

Measurements in mm. of the type are: Length 14.3, to δ pore 3.7; widths, buccal ring .4, at δ pore 1.2, maximum (ca XIX) 1.6, anus .7; depths not measured but nearly uniformly from .4 to .6; diameter of caudal sucker .9 mm. All of the specimens are very nearly of the same size.

Lip subtriangular, altitude about $\frac{2}{3}$ base. Labial eyes usually one pair, probably on III but as the annuli are undefined this was not definitely determined; widely separated by nearly 4 times their diameter, conspicuous, black, and with the cups directed forward. On 2 specimens a very minute eye is present before each of the larger ones. On some examples a pair of small lateral buccal eyes on V but usually these are absent or indiscernible; deep-seated, lateral accessory eyes are regularly present on somites VI to IX, with some variation. Clitellum only faintly developed on somites XI and XII and contiguous parts of X and XIII. Gonopores separated by 5 annuli, the δ XII $b1/b2$, the φ XIII $b1/b2$, the former large and circular, transversely elongated or crescentic with the horns directed caudad, the latter a very minute, round pore often indicated merely by a whitish dot. No accessory glands or pores were detected on any of the specimens. Nephropores not observed. Anus a rather conspicuous, slightly elevated opening at the level (XXV/XXVI) of the anterior rim of the sucker and well in advance of the base of the well-marked and unusually slender peduncle. Caudal sucker circular, thin, large for an erpobdellid. Surface smooth, without papillae, and sensillae not determined.

Translucent, colorless except for the eye pigment, duskiness of the posterior part of the pharynx and brownish yellow botryoidal tissue in the deeper parts which impart to the caudal half a delicate cream color. A pair of opaque white spots at XIV/XV is due to a mass of mature spermatozoa in the enlarged end of each ejaculatory bulb.

Annulation: Distinct except on head (I-V) where it is completely obliterated. VI 3-annulate dorsally, 2-annulate ventrally, where $a1$ and $a2$ unite to form the post-buccal ring. VII 3-annulate, $a1 < a2 < a3$. VIII usually 4-annulate $a1 > a2 > b5 = b6$ but on some specimens $a1$ is divided into $b1$ and $b2$ making it 5-annulate. IX 5-annulate, $b1 = b2 < b5 < a2 < b6$. X to XXIV 5-annulate, $b1 = b2 = b5 < a2 < b6$, $a2$ and $b6$ larger and faintly subdivided. XXV 3-annulate, $a1 > a2 > a3$. XXVI 2-annulate. XXVII 1-annulate.

Anatomy: The internal anatomy agrees very closely with that of *B. weberi* (Bl.). Pharynx long and muscular, reaching to XIV, strepsilaematous, with the usual 3 muscular ridges twisted through 60° . The stylets, which are damaged or dissolved in most specimens, are rather large, stout cones of which 2 are placed in tandem on the jaw end of each muscular ridge. Nothing distinctive was noted in the stomach or intestine, which are mostly

nearly empty but in some cases contain remains of Ostracods and Copepods. The δ bursa (fig. 62) is unusually spacious, in some specimens flattened spheroid, in others, in which the atrium is retracted, more elongated and pyriform. The atrium is very small, varying in form from short pyriform to more elongated fusiform. The ectal or distal part is thick-walled and muscular with a very narrow lumen, and projects into the cavity of the bursa as a short conical papilla with a pore at the apex which in 2 specimens is projected into the δ pore. The ental end has thinner walls and a more expanded cavity, which receives the paired ducti ejaculatorii. There are no separate cornua distinct from the latter but the narrow muscular ducti curve smoothly laterad and caudad and gradually increase in diameter to form the straight, elongated, highly muscular, club-shaped ejaculatory bulbs which in XIV reach their greatest diameter of about 4 times that of the anterior end of the duct and then contract abruptly into the sperm duct. The latter are relatively coarse tubes about $\frac{1}{3}$ the diameter of the ejaculatory bulbs, arranged in wide and close folds through XV and XVI and in XVII again becoming narrowed to the capillary vas deferens which continues to XIX. Testes sacs only 13 or 14 on each side, forming series extending along the vas deferens in somites XVII to XIX. The vagina is a short, narrow tube rising nearly to the nerve cord where it bifurcates into the short oviducts which gradually expand into the irregularly tubular ovisacs lying beneath the ejaculatory bulbs and reaching to the end of XIII or slightly into XIV.

Christy Tanganyika Exp., Kapili, Lake Tanganyika, No. 450, Oct. 28, 1926, under stones on muddy shore, type and 19 others with *S. perspicax*; same, 415, 1 with *S. perspicax*. Type in British Museum of Natural History. It is possible that some others may have been included among large lots of young *Salifa perspicax*, which they closely resemble superficially.

The generic position of this species is doubtful. On the one hand it resembles the *Salifa-Herpobdelloidea-Nematobdella* complex, especially in the possession of post-cephalic eyes and the absence of accessory copulatory pores, and on the other *Barbronia* strikingly in the peculiarities of the organs of reproduction. For the present, until our knowledge of these small leeches is more complete, and in spite of the differential features, I prefer to place it with the latter rather than to establish a new genus. It is possible that when the seasonal and growth changes in the reproductive organs of these African Erpobdellidae are better known a different conclusion will become necessary. Specifically it differs in many respects, especially in peculiarities of annulation and in the number and distribution of the testes, from any previously described species.

Mimobdella africana, new sp. Plate 27, figs. 39, 40.

The type and only specimen in moderate contraction measures in mm.: Length 33.3, to δ pore 7.3; widths, buccal 1.8, δ 4., maximum (ca. XIX) 6.8, anus 4.5; depths at same points ca. 1.5, 3.8, 3., 2., caudal sucker 3.6. Form elongate ovate-lanceolate, with the width nearly uniform in the caudal

$\frac{2}{3}$ (post-clitellar), but regularly tapered to head in the cephalic $\frac{1}{3}$; moderately depressed in caudal $\frac{1}{2}$ but nearly terete in genital and pregenital regions. Very firm and hard throughout. Lip prominent, nearly flat, trianguloid, with rounded apex, dorsum smooth and almost free from furrows and wrinkles, venter delicately areolated. Eyes visible only after clearing, one pair on anterior part of lip (somite not definitely determined), very minute, pigmented, widely separated. Buccal ring or posterior lip coarsely furrowed with deeply crenulate margin. No obvious clitellum. δ pore at XII $c2/b2$, a large, transversely elongated opening with raised crenulate lips in a small, slightly tumid, elliptical area, the whole and surrounding area based on three annuli each way, slightly elevated to form a low dome. φ pore at XIII $c2/b2$ a very minute and inconspicuous orifice in the furrow a full somite of 4 large and 3 small annuli behind the δ pore. Nephropores on the caudal half of 1st large annulus ($b2$) of most post-genital somites to XXIV but not detected on XI or anterior somites. Skin very smooth and slippery. Segmental sensillae not seen and non-segmental papillae very minute. Under strong illumination and moderate magnification they can be seen as minute white dots on most annuli of the caudal half, especially toward the margins. Farther caudad they become somewhat larger and on most of the larger annuli 10 to 12 may be counted in a transverse row. In this region also 3 pairs of faint longitudinal ridges are present on the dorsum and extend on to the sucker. Anus large, well in advance of caudal sucker at XXVI/XXVII. Caudal sucker, as usual in the family, thick, with stout peduncle, about $\frac{1}{2}$ body width in diameter, dorsum faintly ridged, venter flat and smooth. Color bluish gray, nearly uniform but paler on head and venter. No spots or other markings.

Annulation: Owing to contraction the annuli are sharply defined except on the head but in the absence of external criteria difficult to interpret. The presence of nephropores on post-clitellar somites probably justifies the determination of $b2$ and this is the basis of the following interpretation. The first 2 small annuli of complete somites are therefore $c1$ and $c2$, the next 3 large ones $b2$, $a2$ and $b5$ respectively, the 6th annulus of intermediate size is $c11$, and the last small one $c12$, making 7 in all. I-IV are constituted of 5 very faintly differentiated annuli on the lip. I and II appear to be 1-annulate, III 2-annulate and IV 2-annulate, the last labial annulus uniting with the first complete annulus (IV $a3$) to form the buccal ring. V 3-annulate dorsally, 2-annulate ventrally, the first forming the post-buccal ring. VI 3-annulate both dorsally and ventrally, $a1 = a2 < a3$. VII 4-annulate, $b5 = b6 < a1 = a2$. VIII 5-annulate, $b1 = b2 < a2 = b5 = b6$. IX 6-annulate, $c12 = c11 < b1 = b2 = a2 = b5$. X 6-annulate, $c12 = c11 < b2 = a2 = b5 < b1$, no subdivision of $b1$. XI is similar to X but larger. XII is either 6- or 7-annulate $b1$ being faintly divided into $c1$ and $c2$ and nearly twice as long as $c11$. XIII-XXII all complete and 7-annulate, $c1 = c2 = c12 < c11 < b2 = a2 = b5$. The actual proportions of the annuli differ somewhat with the degree of contraction; when very strongly contracted all of the larger annuli may appear duplex. XXIII 5-annulate $a2 > b1 = b2 > b5 = b6$, the first 4 all duplex. XXIV, 4-annulate, $b1 = b2 < a2 < a3$. XXV 3-annulate $a1 > a2 > a3$. XXVI 2-annulate ($a1 + a2$) $> a3$; 3 transverse rows of minute papillae corresponding to the 3 primary annuli. XXVII 1 post-anal annulus.

Unfortunately nothing is known of the internal anatomy as the single, apparently immature specimen is not available for dissection. There is, however, no doubt of the correctness of the generic reference.

"Mbula Island, Lake Tanganyika, Northern Rhodesia, Miss C. K. Ricardo, No. 415, February 2, 1937. Taken on a pebbly beach on a generally rocky shore with small fish and insect nymphs". Type specimen in British Museum of Natural History.

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EXPLANATION OF PLATES 25 to 28

All leeches were under water when photographed and except when otherwise stated both dorsal and ventral views are shown.

PLATE 25.

- Fig. 1.—*Glossiphonia disjuncta*. Type, Worthington, Sta. 716, Lake Bunyoni. $\times 3$.
- Fig. 2.—*Helobdella conifera*. Paratype, Omer-Cooper, Mt. Chilalu, Abyssinia. $\times$ ca. 3.
- Figs. 3, 4.—*Placobdella jaegerskioldi*. Two small examples showing attached ciliates. Avahuli, Congo, Lang-Chapin Congo Exp. A.M.N.H. No. A 4542. $\times 3$.
- Figs. 5, 6.—*P. aspera*. Dorsum of two and venter of one. Medja, Belgian Congo. Lang-Chapin No. 100. $\times 2\frac{3}{4}$.
- Fig. 7.—Same. Dissection of gastric caeca from dorsum. $\times 2\frac{1}{2}$.
- Fig. 8.—*P. pulchra*. Type and paratype from dorsum. Christy Tanganyika Exp. No. 441. $\times 3$.
- Fig. 9.—*P. pulchra*. Northern Rhodesia, Ricardo No. 49. $\times 2\frac{3}{4}$.
- Figs. 10, 11.—*Theromyzon cooperi*. A.M.N.H. 5773, Abyssinia. $\times 1\frac{1}{2}$.
- Fig. 12.—*Placobdella stuhlmanni*. Worthington 1931, 27(2), ventral only. $\times 3+$.
- Figs. 13, 14.—*Phyllobdella maculata*. Middle one type. Christy Exp., No. 432S, Kirando. $\times 2+$.
- Fig. 15.—*P. maculata*. Portion of caudal fin of host (*Barbus tropidolepis*) showing scar of attachment. $\times 3$.
- Fig. 16.—*Placobdella stuhlmanni*. Omer-Cooper, Serpent Lake, Abyssinia. $\times$ ca. 3.
- Fig. 17.—*P. stuhlmanni*. A.M.N.H. 5773, Abyssinia. $\times 1\frac{1}{2}$.

PLATE 26.

- Fig. 18.—*Helobdella conifera*. Type, Worthington, Sta. 707A. $\times$ ca. 3.
- Fig. 19.—*Batrachobdella tricarinata*. Worthington 1931, Sta. 520(2). $\times$ ca. 3.
- Fig. 20.—*B. quadrata*. Paratype. Omer-Cooper, Abyssinia. $\times$ ca. 3.
- Fig. 21.—*Placobdella auroguttata*. Type, Worthington, Sta. 123A. $\times 3+$.
- Fig. 22.—*P. multistriata*. Du R., Liberia, Bequaert. $\times 2\frac{1}{2}$.
- Fig. 23.—*P. fimbriata*. Worthington, Sta. 217A. $\times$ ca. 3.
- Fig. 24.—*Myzobdella africana*. Type, Nairobi, Christy 1916. $\times 1$.
- Fig. 25.—*Hirudo hildebrandti*. Nairobi, Mearns, 1910, U.S.N.M. $\times 2\frac{1}{2}$.
- Fig. 26.—*Praobdella guineensis*. Monrovia, Liberia, Bequaert. $\times 1\frac{1}{2}$.

PLATE 27.

- Fig. 27.—*Myxobdella maculata*. Type, Mopu, Congo, Lang-Chapin. $\times 1\frac{1}{2}$.
 Fig. 28.—*Hirudo michaelsoni*. Lake Naivashi, Worthington 1931, Sta. 27(2). $\times 1\frac{1}{2}$.
 Fig. 29.—*H. sjöstedti*. N. Rhodesia, Ricardo. $\times 1$.
 Fig. 30.—*Limnatis nilotica*. Abyssinia, B. Brown, A.M.N.H. No. 5773. $\times 1$.
 Fig. 31.—*L. oligodonta*. Faradje, Congo, Lang-Chapin No. 551. Johansson pattern. $\times 1$.
 Fig. 32.—*L. oligodonta*. Lake Naivashi. U.S.N.M. No. 51304, Harding pattern, dorsum only. $\times 1\frac{1}{2}$.
 Fig. 33.—*L. africana*. Lado Enclave, Uganda, U.S.N.M. $\times 1\frac{1}{2}$.
 Fig. 34.—*L. obscura*. Type, Naukluft Mts. K. Jordan. Dorsum only. $\times 1\frac{1}{2}$.
 Fig. 35.—*L. fenestrata*. Type, Bechuanaland, de Schauensee, A.N.S.P. No. 4172. $\times 1\frac{1}{2}$.
 Fig. 36.—*L. fenestrata*. N. Rhodesia, Ricardo 252(7). $\times 1$.
 Fig. 37.—*Salija elongata*. Type, Kirando, Christy Tanganyika Exp. No. 453. Dorsum only. $\times 2$.
 Fig. 38.—*S. perspicax*. Abyssinia, A.M.N.H. No. 5773. $\times 1\frac{1}{2}$.
 Fig. 39.—*Mimobdella africana*. Type, Mbula Isl., N. Rhodesia, Ricardo, No. 415. $\times 1\frac{1}{2}$.
 Fig. 40.—Same. Right side. $\times 1\frac{1}{2}$.
 Fig. 41.—*Limnatis oligodonta*. Kala, L. Tanganyika, Christy, 1926. Unusual color pattern like *Hirudo speciosa*. Dorsum only. $\times \frac{1}{2}$.
 Figs. 42-48.—Dissections of reproductive organs in situ. All but 44 and 45 from dorsal aspect.
 Fig. 42.—*L. oligodonta*. L. Naivashi. U.S.N.M. No. 51304. $\times 1\frac{1}{2}$.
 Fig. 43.—*L. fenestrata*. Type, A.N.S.P. No. 4172. $\times 1\frac{1}{2}$.
 Fig. 44.—*H. hildebrandti*. Nairobi. U.S.N.M. Ventral. $\times 1\frac{1}{2}$.
 Fig. 45.—*H. sjöstedti*. N. Rhodesia, Ricardo, No. 28a. Ventral. $\times 1\frac{1}{2}$.
 Fig. 46.—*L. africana*. Cunga, Angola, U.S.N.M. 23272. $\times 1\frac{1}{2}$.
 Fig. 47.—*L. africana*. Monrovia, Liberia, Bequaert. $\times 1\frac{1}{2}$.
 Fig. 48.—*L. fenestrata*. N. Rhodesia, Ricardo, No. 42(5). $\times 1\frac{1}{2}$.
 Fig. 49.—*L. nilotica*. Jig Jigam, Abyssinia, B. Brown, Gastric caeca, engorged with blood, from dorsum. $\times 1$.

PLATE 28.

With the exception of Fig. 61, all drawings are outlines of dissections of the reproductive organs, omitting the testes sacs and in most cases showing the ♂ and ♀ organs in their approximate relation to each other. *be*, bulbous ejaculatorius; *cod*, common oviduct; *de*, ductus ejaculatorius; *ep*, epididymis; *ga*, albumen or oviducal gland; *g* XI-XIII, ganglia of ventral nerve chain; *o*, ovisac; *od*, paired oviduct; *pr*, prostate region of atrium; *ps*, penis sac or stem of atrium; *t*¹, first testis sac; *va*, vagina; *vad*, vaginal duct; *vd*, vas deferens; ♂, male gonopore; ♀, female gonopore.

- Fig. 50.—*Myxobdella maculata*. Type, from dorsum. $\times 6$.
 Fig. 51.—*M. africana*. Type, from venter, the atrium displaced caudad. $\times 6$.
 Fig. 52.—*Praobdella guineensis*. Monrovia, Liberia, from dorsum, the vagina unfolded and displaced caudad. $\times 4$.
 Fig. 53.—*Hirudo sjöstedti*. Rhodesia, Ricardo 28a. ♀ organs from venter. $\times 4$.
 Fig. 54.—*Limnatis obscura*. Type, Naukluft Mts. From venter. $\times 12\frac{1}{2}$.
 Fig. 55.—Same. Paratype. $\times 8$.
 Fig. 56.—*L. fenestrata*. Type, Bechuanaland, from dorsum, the oviduct cut to permit unfolding of vaginal duct. $\times 6$.
 Fig. 57.—*L. africana*. Cunga, Angola, from dorsum. $\times 4$.
 Fig. 58.—*L. nilotica*. Between Abyssinia and British East Africa. U.S.N.M. No. 5501, from dorsum. $\times 4$.
 Fig. 59.—*L. oligodonta*. Lake Naivasha. U.S.N.M., from dorsum. ♂ $\times 5$, ♀ $\times 10$.
 Fig. 60.—*Hirudo hildebrandti*. Nairobi. U.S.N.M. From dorsum. $\times 8$.
 Fig. 61.—*L. africana*. Lado Enclave, Uganda. U.S.N.M. Right paired jaw. $\times 40$.
 Fig. 62.—*Barbronia delicata*. Christy Tanganyika Exp. No. 450. Outline of atrium and bulbi ejaculatoria. Shaded portion a mass of spermatozoa. $\times$ ca. 15.

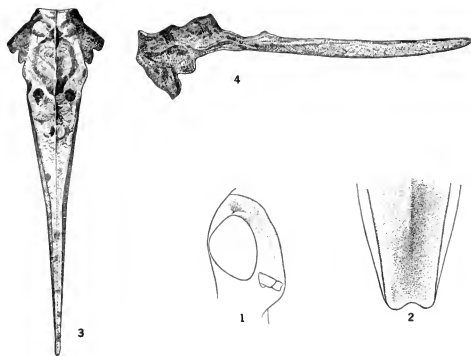
STUDIES IN AFRICAN ACRYDIINAE (ORTHOPTERA, ACRIDIDAE)

PART 2. NEW GENERA AND SPECIES, AND CRITICAL
NOTES ON PREVIOUSLY-KNOWN FORMS

BY JAMES A. G. REHN

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Reference is made to Part 1 of this series, which appeared some time past.¹ The present contribution is composed of new and critical information in large part assembled for use in more comprehensive sections of this set of studies. Delay in the completion of work on certain relative large and difficult genera, and the acquisition in certain very extensive locust



Text-figures 1-4.

Seyidotettix swahili new genus and species, female (type). Mazeras, Kenya Colony. No. 1.—Profile of interocular portion of head. (Greatly enlarged.) No. 2.—Dorsal view of apex of pronotum. (Greatly enlarged.) *Lamellotettix bule* new species, female (type). Lolodorf, Cameroons. No. 3.—Dorsal view of pronotum. ($\times 5$.) No. 4.—Lateral view of pronotum. ($\times 5$.)

series of new genera of the present group, has made it advisable to have the present information available to other students.

In addition to the British Museum of Natural History, whose cooperation has already been acknowledged, I wish to thank the authorities of the Carnegie Museum, the American Museum of Natural History, the United

¹ Proc. Acad. Nat. Sci. Phila., LXXXII, pp. 91-137, pls. 1-4, (1930).

States National Museum and the Transvaal Museum, for assistance which has made the present study possible. The collections of the Academy of Natural Sciences of Philadelphia, and the Hebard Collection there deposited, have naturally been the most important source of the data here presented.

In the following pages three new genera and five new species are described, a generic assignment of a previously-known West African species to an otherwise Oriental genus (*Tefrinda*) is made, thus adding the genus to the Ethiopian fauna, while certain new synonymy is established. The distributional information here given on certain species which are briefly discussed adds very materially to our knowledge of their range, while the variational data given on the same forms should have important bearing upon future critical studies.

CLADONOTAE

SEYIDOTETTIX² new genus

A member of the same complex as *Medinophyllum* Hancock and *Trypophyllum* and *Acmophyllum* Karsch, but more nearly related to *Medinophyllum* than to the others. From *Medinophyllum xerophylloide*, the genotype of that genus, the present one can be distinguished at once by the broad and even arcuation of the fastigio-facial angle when seen in profile, the more flask-shaped frontal scutellum, the retention of the juvenal type of pronotum into the adult condition, with the absence of evident tegmina, the failure of the foliaceous pronotal expansion to reach the apex of the caudal production of the pronotum and the weakly lamellate dorsal margin of the caudal femora. The non-perforated character of the pronotal foliaceous expansion will, in addition, separate *Seyidotettix* from *Trypophyllum*, while the absence of juxta-ocular processes, the less produced and epaulet-like caudo-lateral sections of the lateral lobes of the pronotum and the simpler and less dentato-lobate ventral margins of the cephalic and median femora will also distinguish it from *Acmophyllum*. The profile of the fastigio-facial angle and facial fastigium suggests *Hypsaeus*, but the non-sulcate pronotal crest and the lamellate cephalic and median femora will at once distinguish *Seyidotettix* from that genus.

Generic description.—Form compressed, semi-ovate, foliaceo-cristate, lacking evident tegmina and wings. Head with fastigio-facial angle broadly arcuate in profile, no juxta-ocular processes present: margins of facial scutellum entire, smooth, in profile low sinuato-arcuate; facial scutellum in cephalic aspect broad ventrad, margins regularly converging dorsad; antennae inserted slightly ventrad of eyes. Pronotum with outline of the crest semi-ovate, subdeplanate mesad, margin entire, non-sulcate,³ cephalic angle

² Named for the Imaum Seyid Said, Sultan of Zanzibar prior to 1856. The coastal strip of Kenya is under the nominal suzerainty of his successors.

³ That is in the sense *Xerophyllum* and its relatives are sulcate. There is a very fine microscopic grooving of the margin but no more than in *Medinophyllum*, which is considered non-sulcate.

projecting cephalad of head, caudal angle not reached by crest, the immediate latter angle deplanate, transversely emarginato-truncate; lateral lobes of pronotum with single caudal sinus. Cephalic and median femora foliaceous expanded, ventral margins undulate, not dentato-lobate. Caudal femora with dorsal margin carinate, non-lamellate, ventral margin entire, non-lobulate. Caudal tarsi ?

Genotype.—*Seyidotettix swahili* new species.

*Seyidotettix swahili*⁴ new species (Plate 29, figs. 1 and 2; text-figs. 1 and 2.)

Type.—♀; Mazeras, Seyidie Province, Kenya Colony.⁵ November, 1921. (R. A. Dummer.) [Hebard Collection, Type no. 1300.]

Size medium (for group); general form as usual in the compressed cristate forms; surface of crest, ventro-cephalic portion of lateral lobes of pronotum and scapular areas of same finely shagreenous and also thickly impresso-punctate.

Head in profile with the arcuate outline of the occiput passing evenly into the faintly sinuate arcuation of the lateral margins of the facial scutellum, with no indication of a fastigio-facial angle; occipital interspace between eyes faintly less than two-fifths greatest width of head, median carina obsolete on occiput proper, juxta-ocular lateral portions of occiput with shallow impressed areas; facial scutellum with its greatest width (ventrad) slightly less than one-fourth greatest width of head, distinctly excavate, lateral margins entire, non-crenulate, regularly straight convergent dorsad, at ventral portion in profile the margins round abruptly and disappear. Eyes in depth approximately equal to one-fifth of head depth. Antennae incomplete.

Pronotum with its median foliaceous crest having the convexity of its margin not uniform and appreciably deplanate mesad, the greatest height from the ventro-caudal angle of the lateral lobes to the dorsal margin very slightly less than half of greatest pronotal length (as 10 to 22), cephalic angle in profile subrectangulate, caudal portion of pronotum surpassing the extremity of the crest by a distance equal to one-eleventh of the total pronotal length, seen from the dorsum this area has its lateral margins regularly but faintly arcuate convergent to the same degree as on the remainder of the caudal three-fifths of the pronotum, immediate apex transversely emarginato-truncate, dorsal surface of this area subexcavate;⁶ actual height of pronotal crest dorsad of general pronotal tectation four-tenths of total pronotal depth; lateral lobes with ventral margin strongly oblique, ventro-caudal production subquadrate, with the more ventral angle narrowly rounded and the more caudal one sharper and nearly a rectangle, humeral sinus distinctly excised, slightly acute; scapular area relatively broad, nearly the proximal fourth of the lateral margin occupied by a marked concave emargination in the usual supra-tegmina position, thence

⁴ After the Swahili people of coastal East Africa.

⁵ Mazeras is on the line of the Kenya-Uganda Railway, sixteen miles from Mom-basa, in the coastal strip, elevation 535 feet.

⁶ The structure of this caudal section of the pronotum is similar to that found in the genus *Diotarus*, of which six Philippine species are now before me. In numerous other features, however, *Seyidotettix* is quite divergent from *Diotarus*.

distad this margin and the lateral carina ⁷ regularly converge, the humero-apical carina (of Hancock) diagonally crossing the scapular area and joining the lateral margin faintly distad of the middle of that portion of the latter between the angle at the caudal end of the "supra-teginal" emargination and the apex: surface of crest with numerous radiating vein-like lines, the impresso-punctations forming a multitude of cribose pale points when held to the light,⁸ these and the surface shagreen giving to this area, and the latter to the cephalic section of the lateral lobes and the scapular area, a very definitely rugulose texture.

Ovipositor robust, tapering, dorsal and ventral margins sharply serrato-dentate.

Cephalic and median femora with the dorsal and ventral margins weakly lamellate, the former with the greatest femoral depth faintly more than half the length, of the latter faintly less than half, in shape the cephalic femur being subelliptical, the median with the margins slightly diverging distad, dorsal and ventral margins of both femora sinuato-undulate, by no means lobate or even lobulate. Caudal femora robust, greatest depth contained two and three-fifth times in greatest length; dorsal margin carinate, non-lamellate, entire, non-lobulate; ventro-lateral carina slightly elevated, entire, non-lobulate; ventro-lateral area broad, deplanate, shagreenous; ventral margin entire, carinate, non-lobulate; caudal tibiae incomplete; caudal tarsi lacking.

General color dresden brown, clouded with pale mummy brown over much of the pronotum, ventral surface almost solidly, face largely, ventral surface of caudal femora in part and cephalic and median limbs on external surfaces obsoletely barred with same. Eyes cinnamon brown.

Length of body, 10.6 mm.; length of pronotum, 12.2; greatest width of pronotum, 4.7; greatest depth of pronotum, 6.29; greatest depth of crest, 2.5; length of caudal femur, 6.62.

The occurrence of an unrecognized genus and species in the coastal section of Kenya is not at all surprising, in view of the fact that this area is far less known zoologically than the country a few hundred miles in the interior. The discovery of *Seyidotettix* helps to indicate, however, the closer affinity of at least a portion of the life of this area to forest land types than is usually realized.

CLADORAMUS Hancock

Cladoramus heros (Bolivar)

1908. *Trachytettix heros* Bolivar, Mém. Soc. Entom. Belg., XVI, p. 84. [Sex ?; Congo.]

BELGIAN CONGO, UELE: Faradje; January, 1913; (American Museum Congo Expedition; Lang and Chapin); 1 ♀; [A.M.N.H.].

⁷ Using this term in the sense used by Hancock.

⁸ There is no approach in the character of this multitude of cribose translucent points to the very definite, few and far larger "windows" found in *Trypophyllum*. The condition in *Seyidotettix* while more evenly distributed and cribose, is no more perforate than the pale and thin chitin areas in the crest seen in *Medinophyllum* would be so considered.

This very remarkable insect, which to date has not been reported since its description, was removed from the genus *Trachytettix* and placed without comment in *Cladoramus* by Bolivar in 1911.⁹ Having before me material of all the African genera of the complex to which it belongs, I have endeavored to satisfy myself as to its generic position. There can be no question of its affinity with *Trachytettix* on the basis of many details of the pronotal and femoral structure, although the supra-cephalic production of the pronotum into a marked process and certain details of the vertex, as the position and character of the juxta-ocular spines, are more as in *Cladoramus*. The dorsal margin of the crest or carina of the pronotum shows cephalad indication of the median sulcation and multilobulate edgings of *Cladoramus* and is not of the more *Pantelia*-like type found in true *Trachytettix*. It is quite possible a new genus may be necessary for the reception of this species, as it is clearly transitional, sharing features which in their pronounced extremes are exceedingly different, as witness *Cladoramus* and *Pantelia*. Until more is known concerning this group, however, and more material of certain species is available, I do not think the generic separation of *heros* would be advisable.

The present specimen measures as follows: length of body, 8.7 mm.; length of pronotum, 12.9; greatest depth of pronotum with lateral lobes, 3.44; width of pronotum across humeral angles, 3.27; width across ventral portions of lateral lobes of pronotum, 4.45; length of caudal femur, 5.2.

TRACHYTETTIX Stål

Trachytettix bufo (Costa)

1864. *Tettix bufo* Costa, Annuario Mus. Zool. Univ. Napoli, II, p. 58. [♀; Natal.]

SIERRA LEONE: Njala; January 26 and 27, 1932, February 11, 1932, October 1931; (E. Hargraves); 3 ♂, 3 ♀, 1 immature ♀; [Brit. Mus. Nat. Hist. and A.N.S.P.].

LIBERIA: Mount Coffee; 1 ♀; [U.S.N.M.]. Muhlenburg Mission; June, 1892; 1 ♂; [U.S.N.M.].

CAMEROONS: Lolodorf; September, October and November, 1926; (A. I. Good); 1 ♂, 6 ♀, 1 immature ♀; [Carneg. Mus. and A.N.S.P.].

BELGIAN CONGO, STANLEYVILLE: Stanleyville; April, 1915; (American Museum Congo Expedition; Lang and Chapin); 1 ♀; [A.M.N.H.].

BELGIAN CONGO, KIBALE-ITURI: Medje; April 10, 1910; (American Museum Congo Expedition; Lang and Chapin); 1 ♀; [A.M.N.H.].

BELGIAN CONGO, UELE: Faradje; January, 1912 and 1913; (American Museum Congo Expedition; Lang and Chapin), 33 ♂, 48 ♀, 1 immature ♂, 1 immature ♀; [A.M.N.H. and A.N.S.P.].

⁹ Mém. Soc. Entom. Belg., XIV, p. 74.

Of this extensive and interesting series but five specimens are macropterous with the caudate type of pronotum. These are a female from Njala, Sierra Leone, the Liberian male and female, one female from Lolor Dorf, Cameroons, and a single male from the Faradje, Belgian Congo representative of thirty-three of that sex.

This series of nearly a hundred adult specimens, eighty-one from a single locality, when taken with others previously studied, representing in all twenty or more localities extending from Sierra Leone to Abyssinia and Natal, presents a good index to the variation which occurs in *T. bufo*. This variation has already been analyzed by me on the basis of previously studied material.¹⁰ The range of structural variation noted in the present series embraces the rugosity of the dorsum of the pronotum, the sharpness of the same and the exact type and marginal details of the humeral productions. These may prove to have an average regional association when even more comprehensive and completely representative series from a greater number of localities have been assembled. At this writing, however, I have no evidence of sufficient weight to warrant the recognition of any valid subspecies of *bufo*. Relative to Sjöstedt's recently described subspecies *voltaensis*¹¹ I would refer the student to my above-mentioned previous discussion of the variation found in this species, which has in part been quoted by Sjöstedt.

The Faradje series shows that, while there is a distinct amount of size variation in any one place, there is a certain average approximation in each locality. The pairs of each sex from the Faradje series measured in millimeters below represent the extreme dimensions found in the abbreviate type of each sex, and the measurements of the single macropterous male are also given.

	Length of body	Length of pronotum	Greatest depth of pronotum (with lateral lobes)	Greatest width across humeral angles of pronotum	Width across ventral portions of lateral lobes of pronotum	Length of caudal femur
♂, ...	4.9	6.2	2.35	3.1	3.52	3.44
♂, ...	7.1	7.5	2.68	3.65	3.86	3.94
♂ (macropterous),	6.9	8.3	2.18	3.19	3.52	3.52
♀, ...	7.9	7.5	2.85	3.61	3.78	3.94
♀, ...	8.5	8.5	3.1	4.03	4.28	4.45

The more noteworthy color types seen in the available series of this species are, first in the general tone, which may be blackish gray, ashy gray or dull ferruginous (from Bitje, Cameroons only); in pale patterns apparently independent of base tone, the more frequent being the buff coloring of

¹⁰ Proc. Acad. Nat. Sci. Phila., LXXXII, pp. 109-110, (1930).

¹¹ Arkiv för Zoologi, 23A, no. 17, p. 4. [♂, ♀; Pundu, Upper Volta.]

the humeral expansions of the pronotum, which varies in extent, and in the presence of restricted buff edgings to the caudo-lateral margins of same. In addition we find pale edgings to the pronotal sculpture and the limb margins. The pale markings are probably genetic in character, as is known to be the case in certain other members of the subfamily.

This species has an extensive area of distribution, ranging from Sierra Leone to Abyssinia, Somaliland and Usambara, Tanganyika Territory, south in western Africa to Damaraland, and in eastern Africa to the Transvaal and Natal. It also occurs on the island of Fernando Po in the Bight of Biafra, West Africa.

ASTYALUS¹² new genus

This very striking new genus, which is a typical cladonotid, has as its nearest relatives *Pantelia* Bolívar and *Trachytettix* Stål, from both of which it can at once be distinguished by the very great reduction in size of the juxta-ocular and medio-fastigial spines and the replacement of a medio-longitudinal crest (*Pantelia*) or series of multidentate lobes (*Trachytettix*) by a median interhumeral boss-like tumidity, as well as the presence of a pair of polished ocelliform nodes on the pronotal dorsum. From *Pantelia* the new genus can also be separated by having the cephalic margin of the pronotum truncate and non-cucullate, and by the more definitely developed humeral angles of the pronotum and herring-bone sculpture of the dorsal surface of the caudal section of the pronotum; from *Trachytettix* it can further be distinguished by the non-pedunculate eyes and the non-lamellate humeral angles of the pronotum. One of the striking features of both phases of the genotypic species is the pair of polished, ocelliform nodes on the dorsum of the pronotum briefly cephalad of the line of the humeral angles.

Generic characters.—Surface rugose, micro-sculpture strongly shagreenous, dorsum of pronotum interhumeraly swollen and elevated on median line. Vertex transversely truncate, juxta-ocular and medio-fastigial subspiniform tubercles present but very short; eyes prominent but non-pedunculate; frontal costa subscutellate, interantennal in position, scutellar margins in profile undulately arcuate; antennae very slender, short. Pronotum with cephalic margin subtruncate, non-produced; medio-longitudinal carina continuously evident but marked only prehumeraly and interhumeraly, humeral angles distinct but little developed; surface of pronotum with a pronounced interhumeral strumosity which is arcuate in profile; caudal production of pronotum with spaced paired rounded tubercles on each side of of median carina, a pair of polished ocelliform nodes on disk briefly cephalad of line of humeral angles; lateral lobes of pronotum with caudo-lateral angles deplanate, lamellate, bi- or tri-dentate, caudal margin with one (brachypterous phase) or two (macropterous phase) sinuses. Tegmina and wings present in macropterous phase, not evident in brachypterous one. Cephalic and median femora with dorsal and ventral margins lamellate,

¹² From 'Ἀστύαλος, a Trojan, in allusion to the buckler-like pronotum.

dentato-lobate; cephalic tibiae slightly and median tibiae distinctly lobate; caudal femora robust, ventral and ventro-lateral margins and certain elements of the pattern of the lateral paginae dentato-lobate. Caudal tarsi with proximal article comprising slightly more than half of entire tarsal length. Venter subdeplanate. Both brachypterous and macropterous phases known to occur.

Genotype.—*Astyalus strumiger* new species.

Astyalus strumiger new species (Plate 29, figs. 3-5; pl. 30, fig. 6.)

Type. — ♀; Elat, Cameroons. November 30, 1926. (A. I. Good.) [Carnegie Museum.]

Form robust, subdeplanate, caudal pronotal production but slightly surpassing apices of caudal femora (macropterous phase); major surface rugosities rounded nodose tubercles, minor surface asperities consisting of a dense and relatively uniform shagreen.

Head seen in cephalic aspect with the lower portion moderately inflated, the greatest width across the genae one and one-quarter times that across the eyes, the genae moderately bullate when seen in same aspect, the genal width also equal to four-fifths the greatest depth of the head: fastigium seen from dorsum with its width equal to slightly less than half width across eyes (as 3 to 6.5), its cephalic margin subtruncate, its surface distinctly concave, the occiput with a median low shagreenous node; paired juxta-ocular tubercles distinct but low, compressed, subspiniform but rounded in profile; median marginal tubercle very low but distinct, blunt, subspiniform: facial scutellum reaching from the median ocellus dorsad to between the paired ocelli, its margins (seen in cephalic aspect) regularly straight convergent dorsad, the width ventrad equal to half the greatest length of scutellum, surface distinctly concave transversely, margins sublamellate, in profile undulately or sublobately arcuate. Eyes in lateral view subovate in outline, moderately prominent, appreciably elevated, their ventral point on a level with the paired ocelli, the fastigium, seen in cephalic aspect, very definitely concave between the eyes, its lowest point little dorsad of median transverse axis of the eyes. Antennae but slightly longer than depth of head.

Pronotum with greatest width across caudo-lateral angles of lateral lobes equal to eleven-twentieths of the greatest pronotal length (brachypterous phase): cephalic margin of disk transversely subtruncate, with two pairs of spaced low nodes, the lateral pair at the marginal end of the short, binodose lateral carinae, which are deeply severed by the first transverse sulcus, and thence can be traced caudad as a fine carination, indefinite in the folded surface between the other transverse sulci, thence diverging to the obtuse-angulate humeral angles, then caudad converging on the caudal process, where before becoming obsolete these carinae are strongly angulato-sinuate dorsad of the insertion of the caudal femora: median carina elevated eroso-lobulate in the vicinity of the transverse sulci, there distinctly compressed, then dropping to subobsolescence and then roundly rising in the domed interhumeral strumosity, the carinal ridge of which is subcompressed and erosulate, thence dropping rather sharply to the carinulate condition found thence caudad; general surface of dorsum with the lateral portions of the interhumeral strumosity rugulosely ascending from the humeral angles to

the median carina, in cross-section being as a whole rectangulate, paired polished ocelliform nodes very distinct, nearer lateral than median carinae, surface roundly tumid; immediate humeral angles very narrowly lamellate and weakly projecting laterad, seen from dorsum very briefly rectangulate; surface of caudal process of pronotum with six paired and spaced rounded nodes, between the proximal four of which are low intercalated much smaller tuberculations or ridges, apex of caudal process blunt acute, in profile appreciably decurved; lateral lobes of pronotum with the produced, subdeplanate, marginally quinque-digitate¹³ caudo-lateral processes relatively prominent; single sinus of the caudal margin of the lobes acutely incised.

No evident tegmina or wings.

Venter of thorax and abdomen distinctly deplanate; ovipositor jaws relatively stout, particularly the dorsal pair, compressed, dorsal and ventral extensor margins rather strongly serrato-dentate; ultimate sternite (subgenital plate) with distal margin mesad obtuse-angulate produced.

Cephalic and median femora with the dorsal margins distinctly and the ventral margins very strongly multo-dentate lamellate, the latter margin on the cephalic femora being more fundamentally trilobate, on the median femora more generally deep crenulate and less lobulate, the median femora as a whole broader than the cephalic; cephalic tibiae low triangularly lobulate proximad on the internal extensor margin and a little more strongly so, slightly distad of the same point, on the external flexor margin. Caudal femora robust, distinctly inflated, in lateral aspect with median width equal to four-ninths of the femoral length; dorsal margin appreciably lamellate, minutely crenulato-undulate, distad terminated by a subacute angle, which is evenly flexed inwards, and is distinct and well separated from the usual smaller, median pregenicular lobulate acute tooth of this margin; ventral margin bearing five spaced, relatively low but well-marked trigonal denticiform lobes, which, as well as the intervening portions of the same margin, are serrulato-denticulate; dorso-lateral face of caudal femora with the usual oblique ridges well indicated, a median group of three and the distal (pregenicular) one being heavier than the others; dorso-lateral carina distinct but low; external pagina with two of the median oblique elements each bearing a dorsal and a ventral elevated node, the ventral more compressed, more lamellate and less truly nodose than the dorsal; ventro-lateral carina with two or three lamellate, marginally serrulato-denticulate lobes similar to those of the ventral margin, the margin between to a degree serrulato-denticulate; caudal tibiae trigonal in section, dorso-lateral margins narrowly lamellato-carinate, with six to eight major spinoso-dentations, between these the margin itself is finely serrulato-denticulate; caudal tarsi with proximal article very slightly longer than distal one.

Allotype.—♂; same data as type except date is December, 1926.

Differing from the preceding description of the female (type) only in the following important features.

Size smaller; form and sculpture almost exactly as in female.

Head with the general inflation slightly less pronounced, the width there equal to less than four-fifths of head depth (eighteen-twenty-fifths) and but slightly less than the width across the eyes (as 6 to 6.5): fastigium seen from

¹³ Individually these may be quinque- or tri-digitate.

dorsum with its width equal to distinctly less than half width across eyes (as 2.6 to 6.5), other details of fastigium as in female; facial scutellum, eyes and antennae as in female.

Pronotum with width across caudo-lateral angles slightly greater proportionately than in female, equal to seven-twelfths of the greatest pronotal length (brachypterous phase): general outline and sculpture of the pronotum as in the female except for a slightly greater accentuation of the carinae and slightly more pronounced character of the major tuberculations.

Ultimate abdominal sternite (subgenital plate) subcompressed, median carina of ventral surface pronounced, angle of margin seen in caudal aspect roundly acute.

Limbs as described for the female.

MEASUREMENTS (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum (across ventro- lateral angles)	Length of tegmen	Length of caudal femur
♂, Elat, <i>allotype</i>	6.9	6.97	4.2	—	4.36
♀, Elat, <i>type</i>	9.2	8.56	4.78	—	5.28
♀, Njala, <i>paratype</i>	8.9	14	4.7	1.84	5.36

In addition to the type and allotype I have before me three male and two female paratypes from Elat, Cameroons, taken by A. I. Good, September, October and December, 1926, and from the collections of the Carnegie Museum and the Academy of Natural Sciences of Philadelphia. These are all in the brachypterous phase and show no noteworthy differences from the type and allotype. In addition I have in hand from the British Museum of Natural History two macropterous females, taken at Njala, Sierra Leone, November, 1931, by E. Hargreaves, and one macropterous male taken at Muhlenburg Mission, Liberia, June, 1892, belonging to the United States National Museum, which I am also considering paratypes. As this phase of the species shows certain features which would make its recognition more difficult when the brachypterous phase is not available, the following noteworthy points of difference from the foregoing description of the brachypterous type may prove of service.

Form more attenuate, the caudal production of the pronotum surpassing the apices of the caudal femora by a distance faintly greater than the length of the caudal femora, the general depression of the body slightly less pronounced, the sculpture and rugosity of the dorsum of the pronotum less pronounced although all the elements of the same are evident and placed as in the type.

Head as in type.

Pronotum with width across humeral angles contained six and three-fourth times in the greatest pronotal length, humeral angles slightly more pronounced, more nearly rectangulate when viewed from the dorsum and in cephalic aspect seen to be more distinctly produced laterad than in the

brachypterous phase; median carina less continuously indicated on caudal production than in the brachypterous phase, paired elements of the surface sculpture of the process as in the other phase but more widely spaced, ocelliform nodes very distinct: lateral lobes with the caudal margin having both the typical and tegminal sinuses marked, the former as in the brachypterous phase, the latter faintly sharper than a right angle.

Tegmina elongate elliptical, the greatest width contained two and one-fourth times in the tegminal length, apex rather broadly rounded. Wings surpassing apex of caudal process of pronotum by a distance equal to depth of the eye.

Limbs as in the brachypterous phase except that the caudal femora are slightly more slender, the greatest width of the same being equal to but seven-twentieths (36%) of their length; marginal development and surface sculpture as in other phase.

Color.—Almost uniform, dully and obscurely mottled with fuscous on face and faintly on pronotum, particularly by tinting of the micro-sculpture, tibiae and tarsi more or less definitely annulate with fuscous; indications of the general tettigid paired posthumeral triangles as seen in certain species. General tone ranging from saccardo's umber to bister, mummy brown and carob brown. The type has a base color of saccardo's umber, the allotype approaches carob brown, while the macropterous individuals are saccardo's umber and bister.

METRODORAE

LAMELLITETTIX Hancock

Lamellitettix bule¹⁴ new species (Text-figures 3 and 4.)

Closely allied to the Upper Guinea *L. mampua* Rehn,¹⁵ known only from the type locality and Mount Coffee, Liberia, but differing particularly in the lower fastigial median carina, the more distinctly trigonal and less arcuately rounded second (interhumeral) lobation of the median carina of the pronotum as seen in lateral aspect, in the more inflated character of the dorsum of the same area (interhumeral) of the pronotal disk, as well as the different disposition of the more cephalic of the paired circular nodes present interhumeraly in the female of *mampua*. In addition there are other less clearly evident features of difference which also may prove of diagnostic value when larger series are examined. The possibility exists that *bule* may prove to be a subspecies of *mampua*, but without intergradation demonstrated by material from the territory between their ranges as at present known, I feel it unwise to assume the genus occurs in the intervening area and that the two forms intergrade.

The genus *Lamellitettix* was known, until 1930, only from the Oriental Region, all three species then known being Indo-Ceylonese.¹⁶ The discovery

¹⁴ Named for the Bule people of the western Cameroons.

¹⁵ Proc. Acad. Nat. Sci. Phila., LXXXII, p. 123, pl. 3, figs. 4-6, (1930). [♀; Bendu, Sierra Leone.]

¹⁶ See Rehn, idem, p. 123, (1930).

of *L. mampua* carried the genus into the West African Subregion. The recognition of *L. bule* extends the range of the genus more comprehensively within that zoogeographic division by showing its presence in the Lower Guinea Forest District.

Type.—♀; Lolodorf, Cameroons. September, 1926. (A. I. Good.) [Carnegie Museum.]

Size subequal to that of the same sex of *L. acutus* Hancock, of Ceylon, the genotype, but caudal process of pronotum more produced than in type of that species; form as a whole very similar to that of *L. mampua*; surface texture much as in *L. mampua*.

Head very similar to that of *L. mampua*; greatest width across genae exceeding by one-fifth that across the eyes; fastigium with proportions and character essentially as in *mampua*, median carina of fastigium more delicate, less evident and distinctly lower than in *mampua*, the lesser elevation making its cephalic outline rounded obtuse-angulate, and hence the fastigium less prominent in profile; facial outline between the antennal bases, in profile, as in *mampua*; frontal costa relatively broad (for genus), its margins, as seen in cephalic aspect, regularly diverging ventrad from a point briefly dorsad of the ocelli ventrad to the median ocellus, where the width separating them is equal to half the breadth of the eye seen in cephalic aspect, sulcation of costa pronounced, more decided dorsad than ventrad. Antennae slender, fifteen-jointed, the distal three very short, the majority elongate, the ninth slightly greater in length than first and second combined. Eyes as in *mampua*.

Pronotum caudate, surpassing apices of caudal femora by a distance slightly greater than caudal femoral length, its general form very similar to that of *L. mampua*; cephalic margin of pronotal disk subtruncate; humeral angles, as seen from dorsum, slightly more rounded than in *L. mampua*, greatest width across same contained five times in greatest length of pronotum; anterior carinae short, low, not pronounced, moderately converging caudad; median carina with emphasis as pronounced as in *mampua*, the major (second) elevation of same more distinctly trigonal, and less rounded, with a definite but obtuse angulation at the highest point and a low secondary or accessory arcuation to the cephalic, or ascending, slope, as seen in profile; surface of the interhumeral section of the disk very definitely more inflated and elevated than in *L. mampua*, in transverse section between the humeral angles showing a quite regularly angulate, although moderately obtuse, tectation, paired accessory prehumeral carinae found in all members of the genus almost lost in the general bullation of that area, subparallel, quite short; cephalic pair of posthumeral tubercles of the disk relatively small, in the same transverse axial position as in *L. mampua* but much closer to the median carina, which they immediately flank, rather than adjacent to the lateral margins, the more caudal pair, which is the larger, being in essentially the same position as in *mampua*: lateral lobes of pronotum as in *mampua*.

Tegmina as in *L. mampua*. Wings reaching to apex of pronotal process.

Cephalic and median femora with the general type of lobation of the dorsal and ventral margins as in *mampua* but the ventro-proximal lobe is appreciably smaller, less evident, and more rounded than the ventro-distal

one in the type of *mampua*. Caudal femora with greatest depth contained three times in length, carinae much as in *mampua* but dorsal one with fewer (at most two) spaced lobations proximad of the pregenicular dentiform one; external pagina with its pattern consisting of six or more clearly defined oblique serrulate carinae in the ventral half or more of the pagina, the dorsal section with five groups of raised serrulations, the axes of these groups at right angles to the more ventral paginal carinae, carina bounding the pagina ventrad provided with a median low triangulate lobulation.¹⁷ Caudal tibiae with six external and seven internal spinules. Caudal tarsi incomplete; character and disposition of pulvilli of proximal article as described for *L. mampua*.

Ovipositor jaws robust, distad narrowing in depth from proximal third, marginal teeth very strong. Ultimate sternite (subgenital plate) V-shaped in transverse section, distal margin straight, transverse, except for a subangulate median production which fits between the basis of the ventral ovipositor valves, and the ventral surface of which is polished, as contrasted with the shagreen of the remainder of the sternite.

General base color prout's brown, paling on sides of caudate production of pronotum, tegmina and pleura and blotches in the proximal section of the caudal femora to russet and tawny, the usual posthumeral paired spots on the pronotal disk and scattered spots on tegmina, lateral portions of caudate production of pronotum, lateral aspects of abdomen and limbs blackish fuscous. Wings suffused with blackish fuscous, the costal field distad subopaque buckthorn brown clouded with fuscous.

Length of body, 10.6 mm.; length of pronotum, 19.6; greatest width of pronotum across humeral angles, 3.58; length of tegmen, 2.44; length of caudal femur, 6.52.

The type of this species is unique.

PSEUDOMITRARIA Hancock

Pseudomitraria pontificalis (Rehn)

1904. *Mitraria pontificalis* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 664. [♀; Mount Coffee, Liberia.]

BELGIAN CONGO, STANLEYVILLE: Stanleyville; April, 1915; (American Museum Congo Expedition; Lang and Chapin); 1 ♀; [A.M.N.H.].

BELGIAN CONGO, UELE: Yakuluku; November, 1911; (American Museum Congo Expedition; Lang and Chapin); 1 ♀; [A.M.N.H.]. Faradje; January, 1912 and 1913; (American Museum Congo Expedition, Lang and Chapin); 1 ♂, 12 ♀; [A.M.N.H. and A.N.S.P.].

These specimens have been compared with a paratypic female in the Academy collection and found to show no noteworthy differences, except that the degree of production of the fastigium fluctuates appreciably. In one extreme the length of the fastigium cephalad of the cephalic margin of the eyes is subequal to the greatest fastigial width, while in the other the greatest length is but nine-tenths of the width. Between the two extremes

¹⁷ This and a smaller one placed half-way to the pregenicular constriction are also present in *mampua*. The second one is not seen in the type of *bule*.

are regular intermediates and both types occur in the female sex. In no case, however, is the production sufficiently short and in any way blunt enough to cause confusion with the Angolan *P. lunda* Rehn,¹⁸ which is here referred to the new genus *Thibron*.

The present records extend the range of this species very greatly to the eastward, and both within and without the forest area. All previous records were from Liberia.

THIBRON¹⁹ new genus

A relative of *Pseudomittraria* Hancock,²⁰ but readily separated by a number of differential features, among which may be mentioned the less compressed form and less quadrate cross-section, the undulate instead of evenly evident and direct median carina of same, the but slightly excavate vertex, the stouter and far less attenuate caudal femora and the proximal article of the caudal tarsus being distinctly longer than the distal one.

The genus comprises the genotype and another species, here described, and *T. lunda* (Rehn).²¹

Generic description.—Form slightly compressed, slender, dimorphic in pronotal and wing development. Head rostrate, face markedly retreating; fastigium of vertex triangularly produced,²² length of same cephalad of eyes less than interocular width at cephalic point of eyes, lateral margins of fastigium carinate, median carina present cephalad of eyes, surface of vertex but narrowly impressed within margins; frontal costa sulcate between ocellar groups; paired ocelli placed between centers of eyes; antennae inserted between lower parts of eyes, slightly shorter than head depth, simple, slender, composed of thirteen articles. Pronotum with median carina continuously indicated, slightly to appreciably undulate in profile, especially cephalad of humeral angles; surface of pronotal disk with or without short accessory paired carinulae interhumeraly. Cephalic and median limbs simple, non-lobate. Caudal femora moderately robust, dorsal carina entire from base

¹⁸ *Pseudomittraria lunda* Rehn, Proc. Acad. Nat. Sci. Phila., LXXXII, p. 134, pl. 4, figs. 6-10, (1930). [♀; Upper Luena River, Moxico District, eastern Angola.]

¹⁹ From *θηβρων*, *Thibron*, a Spartan general.

²⁰ I have already given a resumé of this genus and the species referred to it in 1930 (Proc. Acad. Nat. Sci. Phila., LXXXII, pp. 133-135, pl. 4, (1930)), as well as discussed the probable generic relationship. I am now very definitely able to confirm the suggestion then made that "the future may possibly show that *Miriatra* and *Pseudomittraria* are not closely related, and the gross similarity of head structure is due to parallelism and not true relationship." I have recently been able to examine material of the Neotropical genus *Miriatra* and now can fully confirm my earlier impression that these genera are not closely related, but instead represent parallel specialization in head structure in stocks which are respectively Ethiopian (*Pseudomittraria*) and Neotropical (*Miriatra*). Clearly *Pseudomittraria* is a derivative of the same stock as *Dinotettix* and *Ibcotettix*, and my *Pseudomittraria lunda*, described in 1930, should be removed to the new genus here described.

²¹ *Pseudomittraria lunda* Rehn, Proc. Acad. Nat. Sci. Phila., LXXXII, p. 134, pl. 4, figs. 6-10, (1930). [♀; Upper Luena River, District of Moxico, eastern Angola.]

²² While produced to a decided degree the fastigium in *Thibron* is not of the strongly deplanate and lanceolate type seen in *Pseudomittraria*. It is difficult to express the character of development found in all the species of *Thibron* except by the use of negative features.

to pregenicular angle;²³ caudal tarsi with proximal article distinctly surpassing the distal in length.

Genotype.—*Thibron mombuttu* new species.

The three species here referred to the genus *Thibron* can be distinguished by the following purely artificial key:

1. Pronotum with greatest width across humeral angles contained more than six times in pronotal length; surface of pronotal disk with pair of supplementary carinae; median carina of pronotum nearly straight, continuous. Tegminal apices definitely acute. Caudal femora more slender, with depth contained three and one-half times in length of same. (Angola.) *lunda* (Rehn)

Pronotum with greatest width across humeral angles contained five and one-half times or less in pronotal length; surface of pronotal disk lacking paired supplementary carinae; median carina of pronotum more undulate. Tegminal apices more rounded. Caudal femora heavier, with depth contained little if any more than three times in length of same 2

2. Form more elongate. Fastigium of vertex acute produced as seen from dorsum. Median carina of pronotum with all undulation present cephalad of line of humeral angles, highest point interhumeraly. Pronotum as a whole somewhat broader across humeral angles. Pronotum caudate. Wings full developed. Cephalic and median femora proportionately deeper. (Cameroons.) *mendax* new species

Form more abbreviate. Fastigium of vertex rectangulate produced as seen from dorsum. Median carina of pronotum with a definite portion of undulation caudad of line of humeral angles, highest point at line of principal transverse sulcus. Pronotum as a whole narrower across humeral angles. Pronotum abbreviate. Wings not evident. Cephalic and median link proportionately more slender. (Belgian Congo.)

mombuttu Rehn

*Thibron mombuttu*²⁴ new species (Plate 30, figs. 7 and 8.)

Compared with the female sex of *T. lunda* (Rehn) the present species is seen to differ in the interspace between the eyes being narrow, equal to less than two-fifths of greatest width across eyes instead of one-half of same, in the median carina of the vertex being not at all evident caudad of the middle of the eyes, while the vertex itself has the lateral angles of the margin less produced, in the face having the interocellar break in outline much more decided, the interantennal section of the frontal costa more arcuate in profile, in the pronotum being broader, stouter and with the greatest width across the humeral angles contained three and three-tenths times in the

²³ Hancock regularly refers to this point as the "genicular spine", but it is rarely spinose and is not truly genicular. Pregenicular angle is more accurate as to position and development.

²⁴ After the Mombuttu people of the northeastern Belgian Congo, one of whose chiefs (Ekibondo) was very cooperative and helpful to the members of the George Vanderbilt African Expedition of 1934.

greatest length of same, instead of six and three-tenths, in the absence of supplementary interhumeral carinae from the pronotal disk, in the median carina of the pronotum being appreciably undulate, in the tegmina being broader, the width three instead of four in length, in the longer and stouter caudal femora and the cephalic and median femora being more slender and elongate.

Type.— ♀; Ekibondo's Village, between Niangara and Dungu, Uele District, Belgian Congo. September 25, 1934. (George Vanderbilt African Expedition of 1934; J. A. G. Rehn, on bare ground of native trail and tall grass areas, along the edge of forest patches.) [Academy of Natural Sciences of Philadelphia, Type no. 5563.]

Size medium: form subcompressed, subquadrate in cross-section, moderately tectate dorsad; pronotal extremity abbreviate, tegmina present, wings not evident; surface of pronotal dorsum rugoso-granulose with numerous small cicatriform points interhumeraly.

Vertex as seen from dorsum projecting cephalad of the cephalic point of eyes a distance almost equal to one and one-half times the width of vertex at same point (as 1.75 to 3), in outline slightly more obtuse than a right-angle, the immediate apex very narrowly rounded, the lateral borders of production nearly straight oblique divergent, rounding caudad to the moderately caudad converging juxta-ocular margins; surface of vertex narrowly impressed within margins, deeply so only at apex, lateral margins moderately carinate, median carina indicated, and there decidedly, only in the portion of vertex cephalad of eyes; fastigio-facial angle, as seen in profile, subacute with immediate apex bluntly rounded: occipital line seen in profile moderately arcuate-ascendant to vertex: facial line distinctly retreating, sinuate between paired ocelli and faintly so at median ocellus, the inter-antennal arcuation, as seen in profile, distinct but low: frontal costa low lamellate ventrad of vertex, forking briefly dorsad of the paired ocelli, which are between the middle of the eyes, the margins subparallel thence ventrad to their encompassing of the median ocellus, sulcation pronounced, V-shaped in section. Eyes but moderately prominent, in cephalic aspect the width across them is seen to be slightly less than that across the genae, in outline, as seen in lateral aspect, ovoid-trigonal, the greatest depth but slightly greater than width ventro-caudad.

Pronotum abbreviate, apex of caudal production failing to reach the apices of the caudal femora by a distance subequal to dorsal length of head, greatest width across caudo-lateral angles of lateral lobes of pronotum contained slightly more than two and one-half times in pronotal length, that across humeral angles of pronotum three and nine-tenth times in length: cephalic margin of pronotal disk low arcuate; anterior carinae distinct, rather widely separated, slightly diverging caudad, deeply interrupted by the cephalic transverse sulcus; lateral carinae distinct but not high, rather weak in the interhumeral region, caudad continuous and distinct to caudal apex; humero-apical carinae very distinct, marked cephalad almost to the principal transverse sulcus, humeral angles very slight as seen from dorsum, no more decided than in *Pseudomitraria pontificalis*, then distad moderately sinuate dorsad of tegmina; median carina entire, distinctly and moderately

elevated throughout, in profile definitely but not at all strongly multiundulate, slightly higher at the principal transverse sulcus than elsewhere; surface of dorsum subshagreenous with numerous small subeicatriform nodulose non-linear asperities scattered chiefly in the inter-humeral area: lateral lobes with dorsal length to tegminal sinus equal to one and one-third times the greatest (caudal) depth of same; cephalic margin straight oblique, ventral margin nearly straight, but slightly declivent caudad, ventro-caudal lobe acute-angulate, its immediate apex narrowly arcuato-truncate, seen from dorsum slightly but definitely deflected ventro-laterad, tegminal sinus but slightly more obtuse than a right-angle, ventral sinus rectangulate, the angle itself narrowly rounded, intervening lobe obtuse-angulate; scapular area narrow, subequal in width in cephalic half, evenly narrowing in caudal half, failing to reach half-way from humeral angle to apex of pronotum.

Tegmina elongate elliptical, reaching to slightly caudad of middle of pronotal scapular field, apex rounded, normally exposed width contained three times in length of tegmen, areolate reticulation of surface irregular and coarse. Wings not evident.

Ovipositor valves strongly compressed, in lateral view elongate and slender, dorsal valves narrowing distad, ventral valves less definitely attenuate, both pairs sigmoid to a greater (ventral) or lesser (dorsal) degree, immediate apices of both pairs appreciably subfalcate, dorsal margins of dorsal pair and ventral margins of ventral pair serrato-dentate; ultimate sternite (subgenital plate) medio-longitudinally carinate ventrad, distal margin arcuato-angulate, median point briefly acute, recurved.

Cephalic and median femora simple, non-lobate; cephalic pair with greatest depth contained slightly more than four and one-half times in their length, median pair with depth contained three and three-fifth times in length, cephalic face of median femora with two carinae other than the marginal ones, the ventral of the two the more sharply elevated: caudal femora relatively stout, with greatest depth contained three times in greatest length of same, not at all deplanate laterad, dorsal margin regularly arcuate in proximal two-fifths, thence weakly sigmoid to pregeniculate angle, the dorsal carina entire, very minutely denticulate, ventral margin distinctly straighter than dorsal; dorso-lateral face with at least ten definite oblique subshagreenous very low rugae; lateral pagina with oblique striae clearly cut; ventro-lateral face sparsely micro-granulose: caudal tibiae with lateral extensor margins, and particularly the internal, sublamellate, with seven external and six internal spines: caudal tarsi with proximal article nearly one and two-fifth times as long as distal (as 25 to 18), distal pulvillus on proximal article slightly longer than the proximal or median pulvilli, which are subequal in length.

Pale base color buckthorn brown, paling to ochraceous-buff on the tarsi, heavily and quite solidly infusate with mummy brown over a large part of the body as follows: face, genae, eyes and lateral lobes of pronotum solidly dark, lateral areas of abdomen almost solidly, the pleura and most of external surfaces of caudal femora (except distad on the dorso-lateral) as well as cephalic and median femora, largely infusate, tegmina clouded with prout's brown, the scapular area of the pronotum with its cephalic two-thirds solidly mummy brown: dorsum of pronotum and vertex and occiput with a distinct but indefinite medio-longitudinal narrow clouding of mummy brown,

divided by a paler pencilling along the median carina, while the lateral interscal areas of the disk are quite pale: antennae pale mummy brown.

Length of body, 12.8 mm.; length of pronotum, 8.56; greatest width of pronotum across lateral lobes, 3.31; greatest width of pronotum across humeral angles, 2.18; length of tegmen, 1.76; length of caudal femur, 6.71.

The type of this most distinctive species is unique. It was taken from the earth of a narrow native trail which threaded its way between groups of huts, each with its little clearing for manioc and other staples. In September, in the latter part of the wet season, the country about Ekibondo's Village was largely covered with that grass, reaching well above one's head, which is so marked a feature of the district to the north of the Congo forest. Scattered quite widely through the grassland were many patches of forest, chiefly along the streams, usually narrow or at least of limited extent, the "gallery forest" of many zoogeographers. Under September conditions insect collecting outside of the forest patches was largely a matter of following trails and working the edges of occupied or recently abandoned clearings. Elsewhere the grass precluded the use of an insect net.

Thibron mendax new species (Plate 30, figs. 9 and 10.)

While the genotypic species of this genus, *T. mombutu* Rehn, described above, is known only from the female, and the present species only from the male sex, they clearly do not represent opposite sexes of the same form. Instead the relationship of *mendax* is more definitely with *T. lunda*,²⁵ from Angola, which I have transferred from the genus *Pseudomitraria* to *Thibron* in erecting the latter. From *lunda* the present species differs chiefly in the more prominent and acutely produced fastigium of the vertex, which in its angulation more nearly resembles that of *Pseudomitraria pontificalis* (Rehn), in the narrower interocular space, in the more definitely sinuate facial line, in the much broader tegmina and less acute and more definitely rounded apices of the same, the stouter cephalic and median femora, in the broader pronotum, which has its greatest width across the humeral angles contained but slightly more than five instead of over six times in the pronotal length, in the absence of supplementary carinae from the pronotal disk, in the slightly undulate median carina as seen in profile, and the more robust caudal femora.

Type.—♂; Lolodorf, Cameroons. November, 1926. (A. I. Good.) [Carnegie Museum.]

Size medium: form subcompressed, elongate, pronotum caudately developed, subquadrate in cross-section, dorsum low tectate with a definite interhumeral boss; tegmina present, wings fully developed: surface of pronotal dorsum subshagreenous with scattered subeicatriform rugae, particularly caudad.

²⁵ *Pseudomitraria lunda* Rehn, Proc. Acad. Nat. Sci. Phila., LXXXII, p. 134, pl. 4, figs. 6-10, (1930). [♀; Upper Luena River, District of Moxico, eastern Angola.]

Vertex seen from dorsum in outline acute-angulate, projecting cephalad of cephalic point of eyes a distance equal to four-fifths the width of vertex at same point (as 2 to 2.5), immediate apex sharp, lateral diverging margins nearly straight oblique, but faintly arcuate, passing by a definite, but broadly obtuse, angle into the very faintly caudad converging juxta-ocular margins; surface of vertex but narrowly impressed within margins, but rather deeply bifossulate within apex, as in *T. mombuttu*, lateral margins moderately carinate, median carina indicated decidedly only as far caudad as the cephalic point of eyes, thence caudad and on occiput represented only by a trace; fastigio-facial angle, as seen in profile, acute with immediate apex bluntly rounded; occipital line seen in profile arcuately ascendant to dorsad of eye, outline of vertex thence cephalad independently and more strongly arcuate: facial line distinctly retreating, quite distinctly obtuse-angulate sinuate at paired ocelli, thus limiting the ventral outline of vertex, and very slightly notched at the median ocellus, the usual inter-antennal arcuation, as seen in profile, very slight, even less evident than in *T. mombuttu*: frontal costa lamellato-carinate ventrad of vertex, forking very briefly dorsad of paired ocelli, which are situated very faintly dorsad of the middle of the eyes, the margins subparallel thence ventrad to their encompassing of the median ocellus, sulcation pronounced. Eyes moderately prominent, in cephalic aspect the width across them is subequal to that across genae, outline, as seen in lateral aspect, ovoid-trigonal, the greatest depth but slightly greater than width ventro-caudad.

Pronotum caudate, apex of production surpassing caudal femoral apices by a distance equal to twice the dorsal length of the head, greatest width across caudo-lateral angles of lateral lobes contained four and one-tenth times in pronotal length, that across humeral angles of pronotum five and one-half times in length; cephalic margin of pronotum very low arcuate; anterior carinae distinct but low, widely separated, subparallel, reaching only to cephalic transverse sulcus; lateral carinae of the type found in *T. mombuttu*, weak in the inter-humeral region, caudad continuous and distinct to caudal apex; humero-apical carinae also as in *mombuttu* in extent and character but humeral angles faintly more decided, sinuation of carinae dorsad of tegmina slightly less decided than in *mombuttu*; median carina weakly undulate cephalad of line of humeral angles, its most elevated point, as well as that of pronotal dorsum, immediately dorsad of tegminal bases, thence distad over the subulate caudal process of even height and emphasis; surface of dorsum rather finely shagreenous, supplied on the caudal process almost entirely with a number of very short subcicatriform rugae, which are longitudinal in disposition, inter-humeral portion of disk with a low and poorly defined but distinct boss-like swelling which makes this the most elevated portion of the pronotal disk: lateral lobes with dorsal length to tegminal sinus equal to one and one-sixth times the greatest (caudal) depth of same; cephalic and ventral margins and form of ventro-caudal lobe as in *mombuttu*, both tegminal and ventral sinuses rectangulate, the latter more sharply so than in *mombuttu*, intervening lobe rounded subrectangulate, seen from dorsum ventro-caudal lobes are slightly but definitely deflected ventro-laterad, as in *mombuttu*.

Tegmina elongate elliptical, reaching nearly to apex of scapular field of pronotum, apex broadly and bluntly rounded, normally exposed width contained three and one-tenth times in tegminal length, areolate reticulation of

surface similar to but finer and less impressed than in *mombuttu*. Wings surpassing caudal apex of pronotum by a distance equal to two-thirds the dorsal length of the head.

Ultimate sternite (subgenital plate) strongly compressed, sharply carinate medio-longitudinally on ventral surface, in lateral aspect subconical, proximal depth of tergite contained one and two-fifths in length of same, apex quite sharply and narrowly V-emarginate.

Cephalic and median femora of the type seen in *T. mombutt* but shorter and stouter, particularly the median, the greatest depth of the latter contained three and one-fifth times in the femoral length: caudal femora as in *mombuttu*, with greatest depth contained three times in length, lateral face slightly more deplanate than in *mombuttu*, sculpture of lateral faces as in latter: caudal tibiae with six to eight external and four to five internal spines: caudal tarsi lacking distal articles, proximal one with proximal and distal pulvilli subequal in length and slightly longer than median one.

Pale base color buckthorn brown, in large part infusate with mummy brown as in *T. mombutt*, the face, lateral lobes of the pronotum and most of the pleura, tegmina and caudal femora quite heavily suffused and the cephalic and median femora, tibiae and tarsi less solidly so, the tibiae and tarsi subannulately and alternately light and dark; eyes prout's brown; antennae pale proximad, darkening distad; dorsum of pronotum almost entirely pale, the low subcicatriform rugae alone darkened, scapular area of tegmina cephalad largely mummy brown; dorsum of head somewhat infusate in a medio-longitudinal area.

Length of body, 14.5 mm.; length of pronotum, 12.75; greatest width of pronotum across lateral lobes, 3.1; greatest width of pronotum across humeral angles, 2.43; length of tegmen, 19.3; length of caudal femur, 6.2.

In addition to the type I have before me an immature female of the species, taken at Lolodorf, Cameroons, April, 1923 by A. I. Good, and from the Carnegie Museum. This specimen has the vertex of exactly the character seen in the type, most of the other distinctive features of the species being masked by the conditions of immaturity.

SCELIMENAE

TEFRINDA Bolívar

1887. *Chthonius* Bolívar, Ann. Soc. Entom. Belg., XXXI, pp. 193, 221. (Not of Koch, 1843.)
1906. *Tefrinda* Bolívar, Bol. R. Soc. Españ. Hist. Nat., VI, p. 391. (Inclusive part dated July, 1906, received in Philadelphia, December 18, 1906.)
1906. *Chthonotettix* Hancock, Gen. Insect., fasc. 48 (Acrididae, Tetriginæ), p. 26 footnote. (Author's dating of manuscript, July 15, 1906.)
1938. *Afrocirotettix* Günther, Stettin. Entom. Zeit., XCIX, p. 121.

The earliest name for this genus, based solely on *Tettix palpalis* Stål, a Philippine species, unfortunately is preoccupied, Koch having used it in the Arachnida some forty-four years previously. This fact apparently became evident to Bolívar and Hancock at about the same time, and substitute names were proposed by each the same year (1906). Of these *Tefrinda* Bolívar appears to have priority.

The genus *Afrocriotettix* has been erected very recently by Günther on the African species *Criotettix nigellus* of Bolívar, here placed in *Tefrinda*. Unfortunately the study in which *Afrocriotettix* is proposed is being published serially, and we have available at this time but a fragment of it, which, as far as the present situation is concerned, is merely a key to the genera of what the author calls the "Scelimenae spuriae", in which Günther places his *Afrocriotettix*.²⁶ No mention is there made of the genus *Tefrinda*, which we can only assume is being placed elsewhere, possibly in the "Scelimenae verae" to which Günther refers in discussion. The genus *Tefrinda*, through its genotype, is clearly known to Günther, as shown by his critical reference to it in another connection.²⁷

When a careful comparison of *T. nigella*, here recorded, is made with the genotype, *T. palpalis*, of which a very extensive series from the Hancock series, now in the Hebard Collection, including material determined by Bolívar, is before me, features of difference are found to be of approximately the same relative value as others used only to separate species in numerous genera of the Aerydiinae. Günther, in the very recent study in which *Afrocriotettix* is proposed, assigns to the same genus, i.e. *Criotettix*, Hancock's *Acantholobus longinotus* and *A. robustus*, paratypes of both of which

²⁶ The study in which this is done is entitled "Revision der Aerydiinae (Orth.), II." I have vainly endeavored to locate Part I, not only in the Stettiner Entomologische Zeitung, in which II appears, but elsewhere, without success. Literature summaries and the "Zoological Record" for the last few years have given no clue. Part II is stated to have "139 Abbildungen auf 8 Tafeln", but unfortunately none are included, although many references to the figures are made through the text, which discusses in detail the forms of but two genera, i.e. *Thoradonta* and *Criotettix*, although three new genera are described in the key to the genera of the "Scelimenae spuriae". An editorial policy which permits the serial appearance of critical papers of this type is unfortunate, to say the least, as new species which form the basis of new genera given in the tables remain undescribed, and must date from a subsequent issue, the genus thus nomenclatorally based on an undescribed species. Similarly the issue of text without relevant figures can lead only to difficulties for subsequent workers, unfair to these individuals as well as the author. From long editorial experience I know finances often control methods of issue, but this factor should never permit such haphazard issue. A paper of this type should be held until funds permit a larger, properly illustrated issue. This is continually done, and for this reason, by American journals of similar scope and character.

Unfortunately Dr. Günther is at times prone to be very critical of the work of others, often without knowledge of or acquaintance with the subjects of his strictures. In another recent study (Nova Guinea (n.s.), II, p. 23, (1938)) he has taken occasion to reflect disparagingly on certain Malagasy genera of Aerydiinae erected by me some few years ago. In particular he states that *Isandrus* Rehn is but weakly distinct from the Ceylonese *Amphinotus* Hancock, although he has never seen the type material of the latter genus, which was before me and referred to when *Isandrus* was described. His broad generalization as to the value of other genera described at the same time similarly lacks weight or point, as he had before him none of the material on which that work was done, while far more extensive representations than originally examined, now available, fully support the conclusions previously reached. A broader acquaintance with the past literature of the group, and especially conclusions which have been drawn from extensive studies on the Nearectic genera, would have been helpful to Dr. Günther, in preventing his dependence upon features of dubious generic worth.

²⁷ Rev. Suisse de Zool., XLIV, p. 126, (1937).

from the Hancock series are now before me. The differences between these are, in relative value, even more decided than those which I here list to separate *T. palpalis* and *T. nigella*.

In *nigella* the distal palpal articles are less expanded and spatulate than in *palpalis*, but this difference is paralleled in congeneric species of other genera; the triangle at the ventral base of the frontal costa in *nigella* is proportionately higher; the sulcation of the frontal costa extends slightly more dorsad in *nigella* than in *palpalis*, and the margins of the sulcate costa are less thickened when seen in cephalic aspect; the face surface, like that of the whole pronotum, is smoother beneath the granules in *nigella* than in *palpalis*; the pronotal surface is more deplanate, and less undulate, but the sculpture is basically of the same general pattern; the median carina is less evident prehumeraly in *nigella* than in *palpalis*; the tegmina are slightly narrower in *nigella*; the caudal femora are more attenuate and the ovipositor valves shorter and stouter in *nigella* than in *palpalis*; the distal spurs of the caudal femora have the internal group definitely instead of but slightly longer than the externals in *nigella* than in *palpalis*.

While the two species are quite distinct, no useful purpose is gained by separating them generically, thus obscuring evident relationship and common origin, which is as much the purpose of taxonomy as to point out differences.

This assignment of *nigella* adds another supposedly exclusively Oriental genus to the fauna of West Africa.²⁸

***Tefrinda nigella* (Bolivar)**

1887. *C[riotettix] nigellus* Bolivar, Ann. Soc. Entom. Belg., XXXI, pp. 223, 225. [♂; Gaboon.]

CAMEROONS: Ebolowa; March 2 and May 23, 1932; (H. C. Wing); 2 ♀; [Carneg. Mus.]. Edea; August-October, 1923; (J. A. Reis); 2 ♂, 5 ♀, 1 immature ♂; [Carneg. Mus.]. Lolodorf; April and May, 1923; September and November, 1926; (A. I. Good); 114 ♂, 105 ♀, 36 immature individuals representing both sexes; [Carneg. Mus. and A.N.S.P.].

²⁸ Günther in his "Scelimenae spuriae" resumé has taken occasion (Stett. Ent. Zeit., XCIX, p. 121) to query the correctness of my reference of a new West African species (*L. bantu*) to the otherwise Oriental genus *Lorilobus*. When *L. bantu* was described (Proc. Acad. Nat. Sci. Phila., LXXXII, p. 112, (1930)) it was stated, as definitely as words can express, that comparison had been made with the female type of the Ceylonese *L. acutus* Hancock, the genotype, and that the two species were closely related. There can be no warrant, without definite reason, for querying such an assignment, which is now completely supported by a recomparison of paratypes of *bantu* with the type of *acutus*. As *bantu* was known from four lots of material, taken in two widely separated areas, erroneous labelling could not be advanced as an argument. This type of distribution is one shared with many genera in numerous groups of animals and a gratuitous query of this sort placed without comment or knowledge, serves no constructive purpose.

Attention has already been called by me to the variation found in *nigella* in the development of the pronotal lateral spines.²⁹ This is equally indicated in the present more extensive representation. Proper valuation of this feature very definitely removes some of the weight which has been placed on the degree of development of these structures as generic criteria in the Scelimenae.

The degree of emphasis and brilliancy of the ochraceous patch laterad on the pleura and on the process of the caudo-lateral angles of the lateral lobes of the pronotum also varies appreciably in both sexes of *nigella*.

ACRYDIAE

DASYLEUROTETTIX Rehn

1904. *Dasyleurotettix* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 658.

Genotype.—*D. curriei* Rehn = *Tettix infausta* Walker.

At the time of its description this genus was referred to the Cladonotae on account of its possession of a quite definite inter-antennal scutellate expansion of the frontal costa, a development as decided and extreme as that found in a number of other genera which had been and still are, so referred. In addition *Dasyleurotettix* possesses a very marked oblique truncation of the extremity of the ventro-caudal production of the lateral lobes of the pronotum, a feature usually characteristic of the Metrodoraе. With these apparently contradictory features it combines a general structure which in virtually all other respects is representative of the Acrydiae (Tetrigiae of Hancock). The latter analogy is so pronounced that Hancock in 1907³⁰ moved the genus to the Acrydiae (Tetrigiae) and placed it near *Acrydium* (= *Tetrix* as used by him), stating *Dasyleurotettix* recalled the European *Tetrix depressus*, as its nearest relative.

I have gone over the matter anew and feel that the position close to *Acrydium*, suggested by Hancock, is the logical and natural solution, yet at the same time it is necessary to point out that such action virtually invalidates the use of the orthodox features of the older literature (facial scutellum and truncation of ventro-caudal lobes of pronotum) as diagnostic of the Cladonotae and Metrodoraе respectively. As far as the development of the facial scutellum is concerned, the genus *Neotettix*, which is clearly a member of the Acrydiae, shows in its known forms enough range in the frontal costa development to cause serious doubt of the value of the facial scutellum as diagnostic of the Cladonotae, while the number of known genera on the borderland of the Metrodoraе and Acrydiae cause recurrent misgivings as to the usefulness of the oblique truncation of the apex of the ventro-caudal lobes of the pronotum as a group feature. It is even fair to

²⁹ Proc. Acad. Nat. Sci. Phila., LXXXII, pp. 111-112, (1930).

³⁰ Trans. Entom. Soc. London, 1907, p. 234, (1907).

say that a nearly uniform gradation exists in known forms in the latter assemblage from a clearly truncate type to one without evident truncation.

I have already expressed a very definite feeling³¹ that more than one of the orthodox sections of the Acrydiinae are arbitrary and unnatural, and cannot be maintained, and that future work will probably show the need for a greater number of more fundamental and natural units. This opinion has been much strengthened by more recent study, but the press of many duties at this time prevents me from attempting a comprehensive study of groups and group values for which there is an increasing need.

In general form *Dasyleurotettix* shows marked resemblance to *Potua* and *Hancockia*, but these similarities are almost wholly due to the stout, sub-depressed form and more general features of the pronotal structure. A more critical comparison soon discloses that these apparent correlations are superficial, and detailed examination makes evident the gap which exists between these Oriental genera and *Dasyleurotettix*, which is in virtually every way more similar to *Acrydium*.

***Dasyleurotettix infaustus* (Walker)**

1871. *Tettix infausta* Walker, Cat. Derm. Salt. Brit. Mus., V, p. 820. [♀; "South Africa"; Natal.]

1904. *Dasyleurotettix curriei* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 658. [♂, ♀; Mount Coffee, Liberia.]

SIERRA LEONE: Njala; August 16, 1926; (E. Hargreaves); 1 ♀; [Brit. Mus. Nat. Hist.].

LIBERIA: Monrovia; September 6, 1920; (O. W. Barrett; "open ground"); 1 ♀; [Hebard Chn.]. Mount Coffee; May, 1894, 1 ♀; [U.S. N.M.]. Muhlenburg Mission; June, 1892; 1 ♂; [U.S.N.M.].

BELGIAN CONGO, STANLEYVILLE: Stanleyville; April 17, 1915; (American Museum Congo Expedition; Lang and Chapin); 1 ♂; [A.M.N.H.].

BELGIAN CONGO, UELE: Faradje; December, 1912 and January, 1913; (American Museum Congo Expedition; Lang and Chapin); 2 ♀; [A.M.N.H. and A.N.S.P.].

ERITREA: Mareb; January; 1 ♂; [Hebard Chn.].

UGANDA: East Madi; September, 1921; (Dr. G. D. N. Carpenter); 1 ♀; [Brit. Mus. Nat. Hist.]. Gulu, Acholi; July, 1929; (Dr. G. D. N. Carpenter); 3 ♀; [Brit. Mus. Nat. Hist.]. "Victoria Nyanza"; 1 ♂; [Hebard Chn.].

PORTUGUESE EAST AFRICA: Busi³² River; December, 1906; (C. F. M. Swynnerton); 1 ♀; [Brit. Mus. Nat. Hist.].

NYASALAND: Kondowe to Karonga; June, 1898; (A. Whyte); 1 ♀; [Brit. Mus. Nat. Hist.]. Mt. Mlanje; December 9, 1912; (S. A. Neave);

³¹ Proc. Acad. Nat. Sci. Phila., LXXXI, pp. 481-482, (1929).

³² Buzi in some charts. This is a tributary of the Revue River which empties into Masansane Bay near Beira.

1 ♀; [Brit. Mus. Nat. Hist.]. Mlanje to Zomba, 2000-3000 feet elevation, May 6-7, 1910; (S. A. Neave); 1 ♂; [Brit. Mus. Nat. Hist.]. Blantyre; 1910; (Dr. J. E. S. Old); 1 ♀; [Brit. Mus. Nat. Hist.]. "Nyasaland" or "Brit. Cent. Africa"; 2 ♀; [Brit. Mus. Nat. Hist.].

SOUTHERN RHODESIA: Salisbury, Mashonaland; October, 1901; (G. A. K. Marshall); 1 ♀; [Brit. Mus. Nat. Hist.].

BECHUANALAND PROTECTORATE: Metsimaklaba; March 7-12, 1930; (Vernay-Lang Kalahari Expedition); 4 ♂, 4 ♀; [Transv. Mus.].

TRANSVAAL: Zoutpansberg, 800 meters elev.; April; 1 ♂: [Hebard Cln.]. Lydenburg district; 1896; (P. A. Krantz); 1 ♂; [Transv. Mus.]. Three Sisters, Barberton district; December; 1 ♀. Rooiplaat; March 20-24, 1906; (C. Swierstra); 1 ♂, 1 ♀; [Transv. Mus.]. Fountain Grove; August 27, 1905; (C. Swierstra); 2 ♀; [Trans. Mus.]. Pretoria; (W. L. Distant); 1 ♀; [Brit. Mus. Nat. Hist.]. Waterberg district; 1898-1899; (Von Jutrzencka); 1 ♀; [Trans. Mus.]. Venterstroom; July 2 and 21, 1910; 1 ♂, 1 ♀; [Univ. of Pretoria.].

NATAL: Weenen; March, 1925; (H. P. Thomasset); 2 ♂, 5 ♀; [Brit. Mus. Nat. Hist.]. Kloof, 1500 feet; September, 1926; (S. A. Neave and R. E. Turner); 4 ♂; [Brit. Mus. Nat. Hist.].

CAPE PROVINCE: Port St. John, Pondoland; April 1-15 and 16-28 and May, 1924; (R. E. Turner); 6 ♂, 2 ♀; [Brit. Mus. Nat. Hist.]. Salem, Albany district; October 1892; (R. Webber); 1 ♂; [Albany Mus.].

The synonymy established above was suggested to me by a label "*Coptotettix infausta* Wlk.," in Uvarov's handwriting, placed upon one of the Weenen individuals, from which I inferred the specimen had been compared with Walker's original material. The Walkerian description is grossly superficial and so utterly inadequate that the recognition of the species from that evidence alone would not be possible. In order to make certain of the identity of Walker's species I requested Dr. Uvarov to compare two specimens of the present species with the type material of Walker's *infausta* in the British Museum of Natural History. The results of his comparison confirm his previous identification of the species and the synonymy of my *curiei* under Walker's far older *infausta* naturally must follow.

The usual gap between the caudate and abbreviate phases is more distinctly bridged by intermediate individuals in this species than usual in the grouse-locusts. There is, however, a larger percentage nearer the abbreviate than the opposite extreme. Extreme caudate types are before me (one in each case unless otherwise stated) from Mount Coffee, Liberia (four females); Stanleyville, Belgian Congo; Gulu, Uganda; Hareb, Eritrea; Blantyre, Nyasaland; Upper Kulungwisi Valley, northeastern Rhodesia (three females); Salisbury, Southern Rhodesia; Venterstroom, Transvaal; Weenen, Natal (three females), and Kloof, Natal. Apparently from the

evidence in hand the extreme caudate condition is less frequent in the male sex than in the female. There is an appreciable amount of size variation but this has no geographic correlation, and a single locality, such as Fountain Grove, Transvaal, will show a marked difference in this respect between two individuals of the same sex. The Metsimaklaba series of eight, on the other hand, are quite uniform in size for the respective sexes.

Color tone shows some variation, some individuals being more distinctly blackish than others, which are uniformly quite grayish. A single female from Mount Coffee, Liberia, is largely dull rufous, and the male from Zoutpansberg, Transvaal is an even duller brick red, while a Weenen, Natal male has a saddle-like marking of the same in a more fuscous base.

The caudate Stanleyville, Belgian Congo, male has the face and limbs marked or annulate with ochraceous to a more decided extent than in any other specimen of the species which I have examined.

There is present an average approximation in tone in some series, in others there is a definite individual tonal range from blackish fuscous to gray brown. The eight specimens from Metsimaklaba, Bechuanaland Protectorate, show a color range from a dark earth brown to a more grayish shade.

The previous records, plus the much more extensive information now available, demonstrate that the species range quite broadly across Central Africa, from Sierra Leone and Liberia to Eritrea, southward over at least a part of the Belgian Congo, across Uganda to Lake Kivu, northeastern Rhodesia, Nyasaland, Southern Rhodesia westward to Victoria Falls, Portuguese East Africa south of the Zambesi, extreme eastern Bechuanaland Protectorate, at least a portion of the Transvaal, much of Natal and the eastern coastal belt of Cape Province south to the Grahamstown district (Salem). No definite records are known to me from the Cameroons or the Gaboon, or any other portion of West Africa except the Upper Guinea districts of Sierra Leone and Liberia, neither have I seen any material from Abyssinia, Kenya or Tanganyika, although it doubtless occurs in at least portions of the latter extensive areas.

It is demonstrated by conditions found in a large portion of its areal distribution to be a species not partial to forest conditions, yet it does occur at localities situated deep within both the Lower and Upper Guinea Forest Subprovinces. Presumably its occurrence is controlled by conditions, as yet unknown, which meet its ecological requirements and these are present within as well as without heavy forest. Some inhibition, however, apparently has prevented the species from reaching southwestern Africa south of the Lower Guinea Forest, within which it is known only from the few Belgian Congo localities here recorded, and Kwidschwi Island, Lake Kivu (recorded by Rehn, 1914).

I feel, however, the species, and incidentally the genus, is one which originated in the grasslands and is intrusive in the forest areas, at the same time developing a definite resistance to the semi-arid conditions found at certain localities from which it is now known.

The relatively extensive series now before me shows but one variational feature which seems to have any definite geographic correlation, this being an average narrower interantennal widening of the frontal costa in the more southern series. This is, however, but an average condition, showing very decided plasticity in every series of any size, as for instance, the extremes found in the females from Port St. Johns, Pondoland come quite close to the extremes found in the whole representation of that sex.

EXPLANATION OF PLATES 29 AND 30

PLATE 29.

- Fig. 1.—*Seyidotettix swahili* new genus and species. Lateral view of female (type). Mazeras, Kenya Colony. ($\times 6$)
- Fig. 2.—*Seyidotettix swahili* new genus and species. Cephalic view of head of female (type). Mazeras, Kenya Colony. (Greatly enlarged.)
- Fig. 3.—*Astyalis strumiger* new genus and species. Lateral view of female (type). Elat, Cameroons. ($\times 5.5$)
- Fig. 4.—*Astyalis strumiger* new genus and species. Cephalic view of head of female (type). Elat, Cameroons. (Greatly enlarged.)
- Fig. 5.—*Astyalis strumiger* new genus and species. Dorsal view of macropterous female. Njala, Sierra Leone. ($\times 5.5$)

PLATE 30.

- Fig. 6.—*Astyalis strumiger* new genus and species. Dorsal view of female (type). Elat, Cameroons. ($\times 5.5$)
- Fig. 7.—*Thibron mombutu* new genus and species. Dorsal view of female (type). Ekibondo's Village, Uele, Belgian Congo. ($\times 6$)
- Fig. 8.—*Thibron mombutu* new genus and species. Lateral view of female (type). Ekibondo's Village, Uele, Belgian Congo. ($\times 6$)
- Fig. 9.—*Thibron mendax* new genus and species. Dorsal view of male (type). Lolodorf, Cameroons. ($\times 5.4$)
- Fig. 10.—*Thibron mendax* new genus and species. Lateral view of male (type). Lolodorf, Cameroons. ($\times 4.2$)

**THE ORTHOPTERA OF THE PHILIPPINE ISLANDS,
PART I. — PHASMATIDAE; OBRIMINAE**

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GENERAL INTRODUCTION

Of the rich and varied faunal sections of the Oriental Realm, the Philippine Islands represent close to the optimum conditions and at the same time are probably the least known portion of the region. Although situated in the northern portion of this great life area, these islands display a variety and complexity in their animal life equalled by few other portions of the world.

The American occupation of these islands during the past four decades provided opportunities for investigations which have materially broadened our knowledge and made possible more conclusive studies, and at the same time emphasized the incomplete character of much of the existing information. The residence of numerous American investigators in these islands has materially assisted scientific studies, and of those of comprehensive character for the biologist perhaps the most important which has been published is that entitled "Distribution of Life in the Philippines".¹ The student interested in problems of the origin and relationship of the Philippine biota will find this important contribution indispensable.

The first comprehensive account of the Orthoptera of the Philippine Islands was that prepared by Professor R. P. Fr. Casto de Elera, as a section of his "Catalogo sistemático de toda la Fauna de Filipinas."² The determinations given by Professor Elera were based largely on the works of Doctor Ignacio Bolívar y Urrutia, of Madrid, Spain, and Doctor Carl Stål, of Stockholm, Sweden. Both of these authors described numerous species of Orthoptera from the Philippines, but unfortunately in most cases without exact locality. Perhaps the most serious difficulty in the present day study of the Orthoptera of this archipelago is the recognition of these older species in the relatively comprehensive representation now available.

¹ By Roy E. Dickerson, et al. Monograph 21 of the Bureau of Science, Manila, Philippine Islands. 322 pp., 42 pls. 1928.

² Catalogo sistemático de toda la Fauna de Filipinas conocida hasta el presente, y á la vez el de la Collection Zoologica del Museo de PP. Dominicos del Colegio-Universidad de Sto. Tomas de Manila. Escrito con motivo de la Exposicion regional Filipinas by R. P. Fr. Casto de Elera. Manila. Imprenta del Colegio de Santo Tomas, 1895. (Orthoptera, pp. 191-223.)

In 1915 the late Professor Lawrence Bruner, long Professor of Entomology at the University of Nebraska, published a catalogue of the orthopteroids of the Philippine Islands which is, however, in very large part, a compilation.³ Undescribed forms are referred to frequently in this catalogue, but unfortunately without diagnoses and hence of no standing taxonomically. The major value of this list is that it brings together in a single publication a summary of the taxonomic literature of the subject to that date.

Perhaps the most comprehensive investigation of the Philippine insect fauna was that of the late Professor Charles Fuller Baker, who was for many years Dean of the College of Agriculture of the University of the Philippine Islands. Professor Baker's extensive collections found their way into the hands of entomologists in all parts of the world, and the pages of the Philippine Journal of Science for many years present concrete evidence of the scientific value of his researches, and the wealth of new information thus brought to light. For some years before his death Professor Baker was in constant correspondence with our colleague, Mr. Morgan Hebard, Research Fellow of the Academy of Natural Sciences of Philadelphia, and important sections of his Orthoptera series reached Mr. Hebard as a gift or in exchange for determinations made during that time. These specimens are now contained in the Hebard Collection deposited in the Academy of Natural Sciences of Philadelphia. The remainder of the Baker series of Orthoptera passed by bequest at his death, with his other insect collections, to the United States National Museum.

For a number of years Mr. George Boettcher operated as a professional collector in a number of the Philippine Islands. The Orthoptera secured by him passed to a well-known German dealer in natural history material, from whom it was acquired by Mr. Hebard and added to the Hebard Collection in Philadelphia. Although acquired with the understanding it was the entire collection, it is now evident that in certain groups the Orthoptera series of the Boettcher representation has been culled. This material in the Hebard Collection, together with that received by Mr. Hebard from Professor Baker and from various other zoologists who have worked in the Philippines, places in the Academy of Natural Sciences of Philadelphia the greatest single series of Philippine Orthoptera in existence. Through the cooperation of the authorities of the United States National Museum we have been privileged to study, section by section, the Baker series contained in that institution. These two great representations give to the present series of studies a background unequalled for comprehensiveness elsewhere in the world. We are further indebted for the cordial cooperation of the

³ II.—Preliminary catalogue of the Orthopteroid Insects of the Philippine Islands. By Lawrence Bruner. Univ. Nebr. Studies, XV, no. 2, pp. 195-281. 1915.

Philippine College of Agriculture through Professor L. B. Uichanco, and the authorities of the Museum of Comparative Zoölogy of Harvard University, both of which institutions have cordially cooperated by placing in our hands important series.

We wish to take this opportunity to thank Dr. B. P. Uvarov, of the British Museum of Natural History, for information concerning some of Westwood's types of Phasmatidae. For many of the drawings and diagrams used in the present study we sincerely thank Dr. M. K. Gyger, and for the remainder of these, as well as for the photographs, we wish to acknowledge our indebtedness to Miss H. Winchester, of the Academy staff.

It is our intention to present the series of studies on the Orthoptera of the Philippine Islands here inaugurated as analyses of systematic units, with the treatment in all cases as uniform as possible. Each section will be complete with keys for the recognition of genera and species and thus of value to students in the Philippines as well as those in research centers elsewhere.

The following geographic works have been our major sources of information of that type: Pronouncing Gazetteer and Geographical Dictionary of the Philippine Islands,⁴ Atlas de Filipinas,⁵ Census of the Philippine Islands,⁶ Official Handbook of the Philippines,⁷ Geographic Names in the Philippine Islands,⁸ and the United States Coast and Geodetic Survey maps.

The institutional source of the material recorded in the present studies is given in each case by an appropriate abbreviation. As stated above, the Hebard Collection is deposited in the Academy of Natural Sciences of Philadelphia, although referred to in these pages as an individual unit.

It is our intention to present at the end of these studies a summarization of conclusions drawn from the material examined, with such generalizations as appear of interest to the students of the biota as a whole.

PHASMATIDAE

The first definite records of individuals of the Phasmatidae from the Philippine Islands were included in Gray's treatment of the genus *Phyllium*,

⁴ A Pronouncing Gazetteer and Geographical Dictionary of the Philippine Islands, United States of America, with maps, charts, and illustrations. Prepared in the Bureau of Insular Affairs, War Department, Washington. Government Printing Office. 1902. 933 pp.

⁵ U. S. Coast and Geodetic Survey, Special Publication, No. 3. 1900.

⁶ Census of the Philippine Islands: 1903. Department of Commerce and Labor, Bureau of the Census: 1909. Bulletin 1. Population of the Philippines. 100 pp. Bulletin 2. The Climate of the Philippines. 103 pp., pls. Census of the Philippine Islands: 1918. In four volumes. Volume I. Geography, History and Climatology. Census of the Philippine Islands. Manila, Bureau of Printing. 1920. xv+630 pp. Illust.

⁷ Official Handbook of the Philippines and Catalogue of the Philippine Exhibit. Louisiana Purchase Exposition, St. Louis, Mo., U.S.A. 1904. In two volumes. Part I. Manila: Bureau of Public Printing. 1903. 449 pp., pls.

⁸ The Geographic Names in the Philippine Islands. United States Board on Geographic Names, Special Report. 1901. 59 pp.

which appeared in 1843,⁹ when three species of the genus were recorded from these islands.

In 1859 Professor J. O. Westwood brought out the classic Catalogue of the Phasmidae¹⁰ in which eight genera and eighteen species, most of them there described as new, were recorded from the Philippines.

The distinguished Swedish orthopterist Dr. C. Stål, published in the seventies four contributions which included descriptions or records of Phasmatidae from the Philippines,¹¹ and of these the section which appeared in the "Recensio Orthopterorum" and the contribution entitled "Orthoptera nova ex Insulis Philippinis descripsit" were the most important to the student of the Philippine walking-stick insects. In the (four) papers of Stål there were discussed or added to our knowledge of the Philippine Phasmatidae seventeen genera and thirty-nine species, of which fifteen genera and thirty-four species were described by him.

Professor Ignacio Bolívar in 1890¹² and 1897¹³ brought out two papers in which he dealt with Philippine Phasmatidae. In these he reported a few new forms.

The veteran orthopterist Karl Brunner von Wattenwyl and his colleague Joseph Redtenbacher published in 1906-1908 their monographic work on the Phasmatidae of the world.¹⁴ In this comprehensive study, which is indispensable to any student of the family, they recorded forty-two genera and one hundred and one species from the Philippines, of which six genera and thirty-four species were described as new. While this great contribution contains an exceptionally large number of errors in citations, in limitation of names and often in the interpretation of the same, it must of necessity be considered a virtual starting point for work on the group. Professor H. Dohrn in his critique¹⁵ of Brunner and Redtenbacher's great work has pointed out numerous errors and certain of his corrections involve Philippine forms.

Other references in the literature of recent years referring to Philippine species of Phasmatidae are almost without exception incidental to discussion of species essentially absent from that fauna.

⁹ Zoologist, I, pp. 117-123, figs.

¹⁰ Cat. Orth. Ins. Brit. Mus., Pt. I, Phasm., 195 pp., xl pls., 8 supplementary pls.

¹¹ "Recherches sur le Système des Phasmides". 1875. Bihang K. Svenska Vet.-Akad. Handlingar, 2, no. 17, 19 pp.

Recensio Orthopterorum, Revue critique des Orthoptères décrits par Linné, DeGeer et Thunberg. III, 1875. 105 pp.

"Espèces nouvelles de Phasmides". 1877. Ann. Ent. Soc. Belg., (C. R.) XX, pp. lxii-lxix.

"Orthoptera nova ex Insulis Philippinis descripsit". 1877. Öfversigt K. Vet.-Akad. Förh., 34, no. 10, pp. 33-58.

¹² "Diagnosis de Orthópteros Nuevos". 1890. Ann. Soc. Españ. Hist. Nat., XIX, pp. 299-334.

¹³ 1897. Actas Soc. Españ. Hist. Nat., 1897, pp. 29-32.

¹⁴ "Die Insektenfamilie der Phasmiden". Leipsig. 1906-1908, 589 pp., 27 pls.

¹⁵ "Beitrag zur Kenntnis der Phasmiden". 1910. Stett. Ent. Zeit., 71, pp. 397-444.

ACANTHOTAXY

During the course of the present study it has been found necessary to devise some system of definitely locating certain elements of the body armature. While we freely admit that in some groups these structures are of no fundamental value, and that in all groups there is at least some variation in them, we have found that many elements of the armature are relatively constant. While this system has been developed primarily for the members of the Obriminae, material of many of the other groups of spiny walking-sticks has been examined, and we believe that with slight modifications the present system may be broadened to include most, if not all, of these forms. The meaning of the term here proposed for a rational discussion of the armature is obvious.

As any worker in this group realizes, there are numerous forms in which there is tremendous variation in structure, pattern and size, but there are also others in which a slight difference in one or all of these may indicate a distinct form. We have found from a careful study of the members of the Obriminae that by far the majority show relatively little variation in these features and particularly in the elements of the armature. As a result many forms may be easily recognized by the differences in these elements.

In common with many of the saltatorial Orthoptera we find individuals of the same form that are either intensive or recessive in the degree of development of the armature, as well as in various elements of the pattern. Moreover, many times the question of just how to describe these elements, i.e. as spines, spinose tubercles, or tubercles has arisen. We have attempted to classify these as uniformly as possible, but, as with all other organisms, one finds forms that are intermediate or border-line cases and as a result the description of the actual character of the armature cannot be thoroughly relied upon. Also when sufficient material was available for study to give us some idea of possible variation we found that the actual character of these elements was usually quite variable, in fact being one of the most variable structures examined in the group.

In this study we have attempted to name the major elements of the armature and in all cases have tried to select names that show as clearly as possible, in a relatively few words, the approximate position of these structures.

In following the present discussion of the armature it will undoubtedly be necessary to consult the accompanying diagrams, in which the approximate position of the major elements of the armature have been indicated. In the descriptions and discussion of the various forms and groups treated in this paper, we have attempted to use consistently the descriptive phrase with which we have designated these elements. Moreover, we have found at times that the lack of some, or most, of the elements indicates differences that are just as important as those evidenced in further developments of the

armature by supplementary elements being found, basic elements becoming compound or by certain of the basic elements combining to form crests or ridges.

In the accompanying diagrams different types of symbols have been used to designate elements of different strength and types.

The large open circles indicate elements that are quite large and conspicuous, and usually simple.

The small open circles show the position of elements that are somewhat smaller, but usually of the same general character.

Large dots show elements that are fundamentally important but of only moderate size and almost invariably simple.

Small dots indicate elements that are usually quite small, but that have diagnostic importance. These are always simple in structure.

The triangular areas on the meso- and metanotum indicate the position of the crests that are formed by the posteriors of these areas.

The circular dotted area (postero-sternal) indicates a low, broad area that evidently is not of the same character as any of the other elements discussed.

The spines or tubercles shown in lateral aspect on the margins are graded in size in accordance with their usual size in members of the Obriminae.

Armature of the Head

Supra-antennals — Consisting of a pair of tubercles or spines situated a short distance behind the bases of the antennae.

Supra-orbitals — Consisting of a pair of tubercles or spines placed slightly mesad and posterior to the compound eyes.

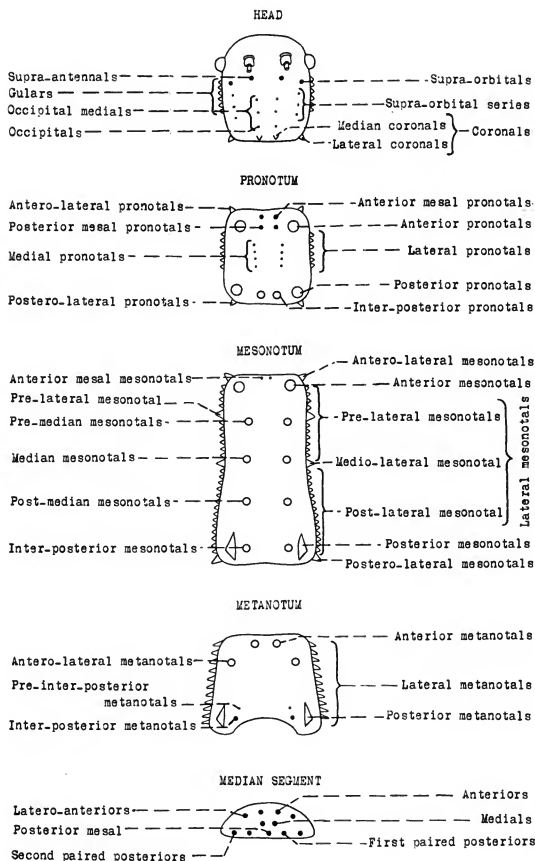
Supra-orbital series — A series of a few small tubercles lying in a longitudinal line behind the supra-orbitals of each side.

Gulars — Usually a row of weak tubercles along the lateral margin of the head, when seen from the dorsum. These lie almost directly behind the eyes.

Occipital medials — A paired row of spines or tubercles extending in a longitudinal line along the dorsum of the head, being slightly laterad of the medio-longitudinal line, and slightly mesad of a longitudinal line from the supra-antennals.

Occipitals — Equivalent to the most posterior element of the occipital medials but usually used only when the remainder of the occipital-medial series is lacking.

Coronals — A series of spines across the posterior margin of the head. This series is often broken into: (a) the *lateral coronals* which consist of a pair of spines or tubercles on the postero-lateral angles of the head; and (b) the *median coronals* which are a pair of spines or tubercles lying laterad of the medio-longitudinal line.



TEXT-FIGURE 1.—Diagram to illustrate acanthotaxy of head and nota, with terminology proposed.

Armature of the Pronotum

Antero-lateral pronotals—A pair of spines or tubercles on the antero-lateral angle of the pronotum.

Anterior mesal pronotals—A pair of spines or tubercles slightly laterad of the median line and but slightly removed from the anterior margin of the pronotum, always before the anterior pronotals.

Posterior mesal pronotals—A pair of spines or tubercles behind and on a line with the anterior mesals, when these are present, and between the anterior pronotals.

Anterior pronotals—The large paired spines on the antero-lateral portion of the pronotal disk.

Lateral pronotals—A series of tubercles or spines occupying the lateral margin of the pronotum, when viewed from above.

Medial pronotals—A series of small paired tubercles or spines lying laterad of the median line and mesad of a line between the anterior and posterior pronotals. These usually occupy the central portion of the pronotal disk.

Posterior pronotals—The large paired spines on the postero-lateral portion of the pronotal disk.

Inter-posterior pronotals—A pair of spines or tubercles which are laterad of the median line, mesad of the posterior pronotals and between a line connecting the posterior pronotals and the posterior margin of the pronotum.

Postero-lateral pronotals—A pair of spines or tubercles on the postero-lateral angle of the pronotum.

Armature of the Mesonotum

Antero-lateral mesonotals—A pair of spines or tubercles on the antero-lateral angles of the mesonotum.

Anterior mesal mesonotals—A pair of small spines or tubercles slightly laterad of the median line, and but slightly removed from the anterior margin of the mesonotum, always placed before the anterior mesonotals.

Anterior mesonotals—A pair of large spines, occupying approximately the same relative position on the antero-lateral portion of the disk, as the anterior pronotals.

Pre-median mesonotals—A pair of spines or tubercles at approximately the anterior fourth of the mesonotum, somewhat laterad of the median line and slightly mesad of longitudinal line from the anterior mesonotals.

Median mesonotals—A pair of spines or tubercles approximately at the middle of the mesonotum, being somewhat laterad of the medio-longitudinal line, and mesad of a longitudinal line from the anterior mesonotals, i.e. on a line with the pre-median mesonotals.

Post-median mesonotals — A pair of spines or tubercles quite similar to the median mesonotals but at the posterior fourth of the mesonotum, being slightly laterad of the median line and somewhat mesad of a longitudinal line from the anterior mesonotals, i.e. in a line with the pre-median and median mesonotals when these are present.

Lateral mesonotals — A series of spines or tubercles occupying the lateral margins of the mesonotum, when viewed from above. This series may be further sub-divided into: (a) the *pre-lateral mesonotals* which occupy the anterior half of the lateral margin, at times one of these at the anterior fourth is enlarged and for convenience may be termed the *pre-lateral mesonotal*; (b) the *post-lateral mesonotals* which occupy the posterior half of the lateral margin; (c) the *medio-lateral mesonotal* which is a single enlarged spine or tubercle at the middle of the lateral margin of the mesonotum.

Posterior mesonotals — A pair or group of large spines on the postero-lateral portion of the disk of the mesonotum. These often form a high more or less trigonal area.

Inter-posterior mesonotals — A pair of spines or tubercles laterad of the median line, slightly mesad of the posterior mesonotals and on a line with the latter.

Postero-lateral mesonotals — A pair of spines or tubercles on the postero-lateral angles of the mesonotum.

Armature of the Metanotum

Anterior metanotals — A pair of spines or tubercles but slightly removed from the anterior margin of the metanotum, and slightly laterad of the median line.

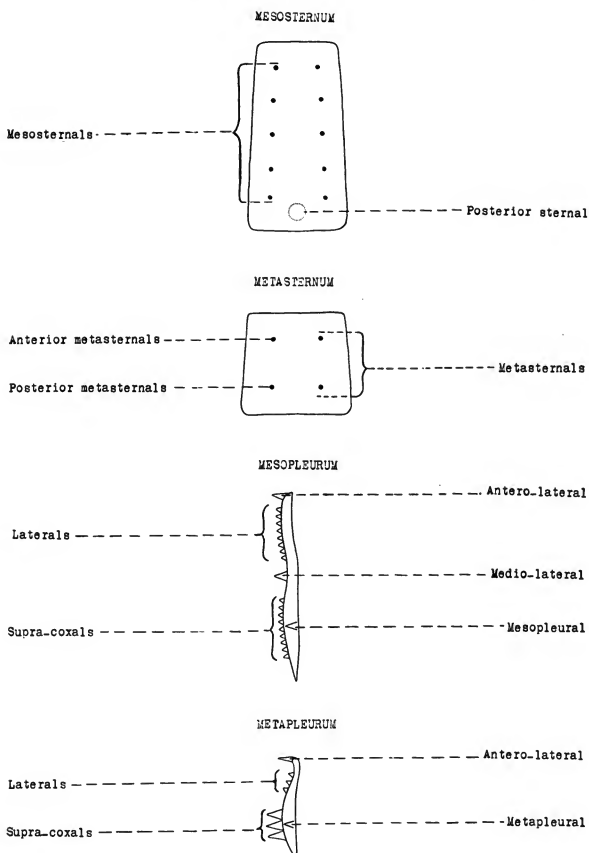
Antero-lateral metanotals — A pair of spines or tubercles on the antero-lateral portion of the metanotal disk, approximately in the same position as the anterior mesonotals, although at times slightly posterior to this position.

Lateral metanotals — A series of spines or tubercles along the lateral margin of the metanotum when seen from the dorsum.

Pre-inter-posterior metanotals — A pair of small spines or tubercles slightly antero-mesad of the inter-posterior metanotals.

Posterior metanotals — Approximately the same in character and position as the posterior mesonotals.

Inter-posterior metanotals — A pair of relatively small spines or tubercles slightly mesad of the posterior metanotals, and approximately on a line with the most anterior portion of the median segment.



TEXT-FIGURE 2.—Diagram to illustrate acanthotaxy of abdominal terga, with terminology proposed.

Armature of the Median Segment and of the Abdomen

Antero-lateral — A spine or tubercle on the antero-lateral angle of the sclerite.

Anteriors — A pair of spines or tubercles slightly laterad of the median line and but slightly removed from the anterior margin.

Latero-anteriors — A pair of spines or tubercles laterad of the anteriors and removed from the anterior margin as much as they are.

Medials — A pair of spines or tubercles which are at about the middle of the sclerite, and but slightly laterad of the median line.

Posterior mesal — A single spine or tubercle on the medio-longitudinal line of the sclerite and at the posterior margin of same.

Paired posteriors — A pair of spines or tubercles on the posterior margin of the sclerite and at a point about one-half the distance from the lateral margins to the medio-longitudinal line.

First paired posteriors — A pair of spines or tubercles placed on the posterior margin of the sclerite and at a point about two-thirds the distance from the lateral margin to the medio-longitudinal line.

Second paired posteriors — A pair of spines or tubercles placed on the posterior margin of the sclerite at a point about one-third the distance from the lateral margin to the medio-longitudinal line.

Postero-lateral — A spine or tubercle on the postero-lateral angle of the sclerite.

Laterals — A series of spines or tubercles along the lateral margin of the sclerite, when viewed from the dorsum.

Posterior quadrangle — A group of four spines or tubercles arranged in a quadrangle, the more posterior ones being practically on the posterior margin of the sclerite and slightly laterad of the median line and the other pair placed a short distance before these.

Full posterior series — A term used to express the condition found in certain forms in which the posterior mesal and the first and second paired posteriors are all present and equally developed.

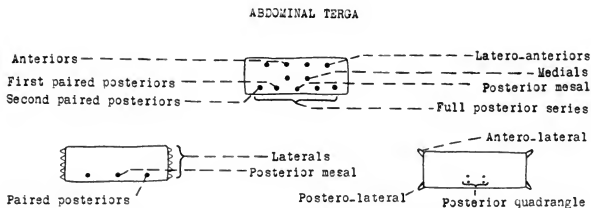
Armature of the Mesosternum

Mesosternals — A longitudinal paired row of spines or tubercles about half way between the lateral margin and the medio-longitudinal line. These elements are often irregularly spaced and the arrangement may be asymmetrical.

Postero-sternal — A broad, low raised area along the mid-ventral line, near the posterior margin. This is usually more or less node-like.

Armature of the Metasternum

Metasternals — A series of spines or tubercles with the same general arrangement as the mesosternals but when only two pairs are present they are spoken of as *anterior metasternals* and *posterior metasternals*.



TEXT-FIGURE 3.—Diagram to illustrate acanthotaxy of sterna and pleura, with terminology proposed.

Armature of the Meso- and Metapleura

Antero-lateral — A spine or tubercle at the antero-lateral angle of the pleura.

Laterals — A group of spines or tubercles that line the lateral margin of the pleura in their proximal half, when viewed from the dorsum.

Medio-lateral — A spine or tubercle at the middle of the lateral margin of the pleura, usually an enlarged lateral.

Supra-coxals — A group of spines or tubercles that occupy the lateral margins of the pleura above the coxae.

Mesopleural or Metapleural — A spine or tubercle that occupies a position above the coxa and usually rises near the mesal margin of the respective pleurum.

OBRIMINAE

The group here termed the Obriminae was first recognized by Brunner and Redtenbacher in their monograph of the family¹⁶ and they considered it to be one of the tribes (Obrimini) of the areolate phasmids. Later Bruner in his "Preliminary Catalogue of the Orthopteroid Insects of the Philippine Islands" treated the complex as the family Obriminidae.¹⁷ In 1923, Karny in "Zur Nomenklatur der Phasmoiden",¹⁸ uses for this group the subfamily name, Therameninae, apparently basing the group on what

¹⁶ 1906. Insektenfam. Phasm., I, pp. 19 and 36.

¹⁷ 1915. Univ. Nebr. Studies, XV, no. 2, p. 228.

¹⁸ 1923. Treubia, III, pp. 230-242.

appeared to him to be the oldest generic name. However, if one followed that system the oldest generic name in the complex is *Hoplocloonia* Stål,¹⁹ and as a consequence the group name would have to be based upon it. But there is no ruling or recommendation in the Zoological Code nor is it general practice to form the group name from that of the oldest included genus, the usual practice being to accept the group name that is most generally recognized regardless of from which included valid genus it is derived. As a result we believe that it is best to continue using a group name based on the genus *Obrimus* for this complex, even though some recent workers have been following Karny's arrangement.

The Obriminae consists of a relatively small but quite well differentiated component group of the areolate phasmids which seem to be confined fundamentally to the Indo-Malayan Region.

The majority of the included Philippine forms are either spiny or rugose, except for the genus *Eubulides*, which is sparsely tuberculate. The prosternum of all the members of the group have two knob-like elevations on the inter-coxal surfaces, the median segment is quite well differentiated from the metanotum, usually broadly transverse in the female sex, but varying from this to subquadrate in the males. The antennae are variable in length but are always longer than the anterior limbs, except in the genera *Ilocano* and *Planispectrum*.

This subfamily is composed of two well differentiated tribes, the Obrimini and the Datamini. The Obrimini have the pronotal foramen at the anterior margin of the pronotum and have the inter-coxal specialization on the prosternum, but lack such a specialized area on the anterior portion of the mesosternum, the antennae usually are distinctly longer than the anterior limbs and the posterior femora are usually at least half as long as the abdomen. Most of the members of this tribe are quite spinose or rugose. The females of this tribe have the operculum elongate and surpassing the more or less elongate ultimate tergite.

The second tribe, the Datamini, has the prothoracic foramen removed from the anterior margin of the pronotum and have in addition to the inter-coxal specialization of the prosternum a similarly specialized area on the anterior portion of the mesosternum. The antennae are usually only slightly longer than the anterior femora, the posterior femora are often quite short, never more than half as long as the abdomen. The females do not have the operculum greatly elongate and it is usually shorter than the ultimate tergite.

The tribe Obrimini is practically limited to the Philippines, although some members of it do reach Borneo and the Tular Islands, but by far the

¹⁹ 1875. Bihang K. Svenska Vet.-Akad. Handling., 2, no. 17, p. 8. The priority of this name over those in the *Recensio Orthopterorum III* is evident from the exact page references in the latter to names proposed in the former.

largest number of forms is found in the Philippine archipelago. However, the Datamini are found through most of the Indo-Malayan Region with the exception of the Philippine Islands.

The tribe Obrimini may be divided into two marked generic groups, one of which, the true obrimoids, includes practically all of the genera of the tribe, while the other contains only *Ilocano* and *Hoplocloonia*.

The true obrimoids are the dominant group of the tribe and have been diversely modified. Probably the most generalized representative of the group is *Eubulides* which is quite simple in most of its morphological features, and is separable from practically all the other genera by the simplicity of its armature. The strongly curved ovipositor, however, is one character in which it seems to be specialized but we believe this to be a secondary development. From this basic stock there are two rather well marked lines, one consisting of *Theramenes*, and the other comprising all the remaining genera with the possible exception of *Mearnsiana* and *Stenobrimus*. Each of these latter two genera may be the sole representative of distinct stocks derived from the *Eubulides* type.

The genus *Theramenes* with its thoracic specialization of the males is quite distinct from the other genera, representing a type of development unknown in the rest of the subfamily. The females, however, show a much closer affinity to *Eubulides* and the other more generalized obrimoids, and they share with the former the strongly curved ovipositor.

The other stock derived from *Eubulides*, which may be termed the true obrimoid complex, represents a rather diverse but at the same time a monophyletic assemblage. The more generalized members of the complex, such as *Heterocopus* and *Aretaon* and its subgenera, differ from *Eubulides* in both the type of armature and in other essential morphological features and may be distinguished from each other by the relative development of the armature. However, in the more specialized forms of the complex there are certain striking morphological differences in the metasternum. The more generalized forms possess the normal type of metasternum with a pair of pits or fossae along the apodemal invaginations, while the more specialized genera have, in addition to this, distinctive specializations on the lateral portions of the metasternum. In the genus *Obrimus* the lateral portions of the metasternum are invaginated and the metapleura are folded under so that this area appears to be partially covered by a flap, giving the appearance of slit-like invaginations along the lateral margin. From this type one goes to the more specialized condition found in *Brasidas* and *Eubrimus* in which the metasternum has deep, open pits which are somewhat removed from the lateral margins. In the former genus these pits are cingulate on the external margin, but this cingulation is either partially or completely lacking on the internal margin. In *Euobrimus* these pits or fossae are of the same general character but they are completely cingulate.

It is probable that *Stenobrimus* is related to *Heterocopus* and *Aretaon*, and represents a lateral specialization from the main stock characterized by its very slender form and its quite distinctive armature.

The distinctive *Mearnsiana*, which is related to the obrimoid complex, and perhaps finds its nearest relative in *Obrimus*, has slight indications of lateral slit-like invaginations, but is characterized by many unusual morphological features and its unique armature.

The *Hoploclonii* constitute a quite distinctive stock which are undoubtedly derived from an obrimoid ancestry. These forms are relatively short and stocky, with rather short, heavy legs, and all the members of this assemblage have at least a faint tendency towards the development of a raised, more or less trigonal area on both the pro- and mesonotum. The general armature of these forms is secondarily simplified and quite distinct from that found in the true *Obrimini*.

The genus *Pterobrimus*, which Redtenbacher placed in the general obrimoid complex, possesses a combination of characters which leads one to believe that it is a member of some other subfamily.

The *Obrimini* as treated by Redtenbacher had seven genera and sixteen species in the Philippines, of which one genus and four species were new. The present paper treats eleven genera and subgenera and forty-three species and subspecies of *Obrimini* from the Philippines, and of these six are new genera or subgenera and twenty-five are new species or subspecies. In the tribe *Datamini* there is one new name.

The following list contains all the species here critically studied, those enclosed in brackets not being known from the Philippine Islands. The linear arrangement here given does not present a true picture of what we consider the phylogeny of the genera, but is the nearest approach to a phylogenetic sequence which the limitations of a linear presentation will permit. Individual phyla have been followed to their logical ends, then a return has been made to the next divergent stock, which by the nature of things may be, in part at least, more nearly related to one some distance removed in the sequence.

Eubulides Stål

alutaceus Stål

igorrote new species

taylori new species

[*spuria* Kirby]

Theramenes Stål

[*olivaceus* (Westwood)]

dromedarius Stål

[*Heterocopus* Redtenbacher]

[*leprosus* Redtenbacher]

- Stenobrimus* Redtenbacher
 bolivari Redtenbacher
 tagalog new species
- Aretaon* new genus
 Aretaon sensu strictiore
 asperrimus (Redtenbacher)
 [*muscosus* (Redtenbacher)]
- Trachyaretaon* new subgenus
 echinatus (Stål)
- Obrimus* Stål
 bufo (Westwood)
 uichancoi new species
 mesoplatus (Westwood)
 bicolanus new species
- Brasidas* new genus
 samarensis new species
 quadratipes (Redtenbacher)
 montivagus new species
 viscayanus new species
 foveolatus foveolatus (Redtenbacher)
 foveolatus asper new subspecies
 acanthoderus new species
- Euobrimus* new genus
 atherura new species
 cavernosus (Stål)
 lacerta (Redtenbacher)
 dohrni new species
 hoplites new species
 bakeri new species
 cleggi new species
- Mearnsiana* new genus
 bullosa new species
- Ilocano* new genus
 hebarði new species
 ranarius (Westwood)
- [*Pterobrimus* Redtenbacher]
 [*depressus* Redtenbacher]
- Hoplocloia* Stål
 [*gecko* (Westwood)]
 draconina (Westwood)
 hystrix new species

lachesis new species
serratoria (Stål)
aspera (Bolívar)
clotho new species
atropos new species
deplanata (Westwood)
armadillo (Redtenbacher)
cervicornis (Bolívar)
spadix new species
tagalog new species
fratercula new species
polillo new species

*Key to Genera*²⁰

1. Pronotal foramen placed at anterior margin of pronotum; anterior mesosternal plate without a raised median sensory area . (Obrimini) 2
 Pronotal foramen removed by more than its length from anterior margin of pronotum; anterior mesosternal plate with raised median specialized, sensory area (Datamini) 13
2. Mesonotum anteriorly with a raised trigonal area *Hoploclonia* Stål
 Mesonotum without a raised trigonal area 3
3. Abdomen, mesonotum and metanotum, except for anterior margin of latter, tuberculate, rugoso-tuberculate or smooth, or with paired conical posterior meso- and metanotal elevations 4
 Abdomen and thorax with definite spines or with spines and tubercles, and often with posterior meso- and metanotal crests 9
4. Tegmina present, lobiform *Pterobrimus* Redtenbacher
 Tegmina absent 5
5. Meso- and metanotum with large, paired conical posterior elevations with numerous small supplementary tubercles; elevations of metanotum connected by a transverse raised area; ventro-anterior margin of all femora and ventro-posterior margin of all but posterior femora with relatively large serrate laminations *Mearnsiana* new genus
 Posterior meso- and metanotals absent, or at most subobsolete; no paired posterior meso- and metanotal conical elevations; femora without such laminations 6

²⁰ The genus *Woodlarkia* of Günther (Mitt. Zool. Mus. Berlin, 17, pp. 755, 759, (1931)) established for *Karabidion scorpionides* Montrouzier, from Woodlark Island (Ann. Soc. Phys. Nat., Lyon, (2)VII, pp. 85, 86, (1885)), is unknown to us in nature as it was to Günther, and has not been placed in the key because the original description, as well as the generic description of Günther, is too incomplete to enable us to determine its position. Quite probably this genus may be a member of some other subfamily. Consequently, until material of the species and genus have been reexamined and analyzed in the light of our present knowledge of the Obriminae, it will hardly be possible to say what are its nearest relatives and whether it should actually be placed in this subfamily.

We have placed *Woodlarkia* at the end of the linear arrangement of genera, in the present treatment, in order to make our summary complete as far as published literature is concerned.

6. Operculum of female curved, in profile; abdomen weakly granulate and weakly carinate medio-longitudinally. (Male abdomen sparsely granulate; meso- and metanotum smooth or anterior margin of either or both with spines, or their surfaces with large median tubercles.) .8
 Operculum straight, in profile; abdomen rather densely granulate and distinctly carinate medio-longitudinally. (Males unknown.) 7
7. Pronotum with anteriors and posteriors tuberculate, without paired posteriorly convergent lines of low tubercles; antennae longer than anterior limbs; ultimate tergite elongate, three times as long as basal width*Heterocopus* Redtenbacher
 Pronotum without anteriors and posteriors, with paired posteriorly convergent lines of low tubercles; antennae shorter than anterior limbs; ultimate tergite not elongate, not more than one and one-half times as long as basal width*Ilocano* new genus
8. Posterior tibiae with lateral margins of flexor surface serrate, or spined distad; pleural margins of meso- and metathorax serrate. Male with a large median tubercle on both mesonotum and metanotum.
Theramenes Stål
 Posterior tibiae with lateral margins of flexor surface relatively smooth; pleural margins of meso- and metathorax either smooth or weakly tuberculate. Males without large median tubercles on mesonotum and metanotum*Eubulides* Stål
9. Metasternal pseudo-foramina absent; either operculum and ultimate tergite (supra-anal plate) short, the operculum not surpassing the ultimate tergite, or operculum elongate and curved in lateral aspect 10
 Metasternal pseudo-foramina present; operculum elongate usually surpassing ultimate tergite, straight in lateral aspect 11
10. Posterior meso- and metanotals simple; operculum and ultimate tergite (supra-anal plate) short, straight; general form slender and elongate.
Stenobrimus Redtenbacher
 Posterior meso- and metanotals composite; operculum elongate, curved in lateral aspect; general form relatively stout ...*Aretoon* new genus
11. Metasternal pseudo-foramina narrow lateral slits at lateral margins, appearing like lateral invaginations*Obrimus* Stål
 Metasternal pseudo-foramina large, open pits near lateral margins ..12
12. Metasternal pseudo-foramina semi-cingulate*Brasidas* new genus
 Metasternal pseudo-foramina completely cingulate.
Euobrimus new genus
13. Antennae distinctly shorter than anterior limbs (pronotum trapeziform; metapleura without a large lateral spine). ...*Planispectrum* new genus
 Antennae as long as, or longer than, anterior limbs 14
14. Occiput conically elevated, spinose or tuberculate, usually with four converging carinae 15
 Occiput not conically elevated, smooth or tuberculate, without carinae 16

Key to Species

1. Anterior margin of pronotum with four large tubercles *alutaceus* Stål
Anterior margin of pronotum with smaller tubercles or less than four
large tubercles 2
2. Anterior margin of mesonotum with four large spines; pronotum with a
large postero-lateral spine *igorrote* new species
Anterior margin of mesonotum lacking four large spines; pronotum lack-
ing a postero-lateral spine 3
3. Occiput with lateral coronals spinoso-tuberculate, median coronals
smaller, tuberculate; pronotum with an antero-lateral tubercle.
taylori new species
Occiput lacking both lateral and median coronals; pronotum lacking an
antero-lateral tubercle *spuria* ²² Kirby

Eubulides alutaceus Stål

1877. *Eubulides alutaceus* Stål, Ann. Soc. Ent. Belg., XX, C. R., p. lxxviii. [♂,
♀; "Insulae Philippinae".]
1895. *E[ubulides]* (sic) *alutaceus* Elera, Fauna Filipinas, II, p. 200.
1904. *E[ubulides]* *alutaceus* Kirby, Syn. Cat. Orth., I, p. 395.
1906. *Eubulides alutaceus* Redtenbacher, Insektenfam. Phasm., I, p. 38.
1915. *Eubulides alutaceus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.
1933. *Eubulides alutaceus* Sjöstedt, Arkiv för Zoologi, 25a, no. 16, p. 2.

This striking species, which has not been rediscovered since its description, seems to be closely related to *igorrote* here described. In both *alutaceus* and *igorrote* the occiput has both the lateral and median coronals; however, in the former the anterior margin of the pronotum is quadrituberculate, while in the latter species this margin has the antero-lateral spines and a pair of small median tubercles. Moreover, in *alutaceus* the anterior margin of the mesonotum is unarmed, while in *igorrote* this margin has four large spines and the antero-lateral tubercles which are somewhat smaller than the spines.

As is the case with most of Stål's Philippine material, no exact locality is given, and, as no one has seen additional material of the species, we can add no information as to its structural features or a more definite habitat.

Eubulides igorrote ²³ new species

Plate 31, fig. 4.

This rather distinctive species is related to *alutaceus* Stål, from which it differs by having the anterior margin of the mesonotum with four spines, while in the latter this margin is unspined. In *igorrote* the pronotum has

²² As the genus is masculine Kirby's use of *spuria* both originally (Ann. Mag. Nat. Hist., (7), XIII, p. 441, (1904)) and in his Catalogue (Syn. Cat. Orth., I, p. 395, (1904)) would indicate that it was derived from the substantive form of this word.

As far as can be gathered from the original description *spuria* was correctly referred to *Eubulides*. The correctness of the cited locality "Australia" is, however, doubtful, the genus otherwise being Philippine in its distribution. In the event that further material of *spuria* supports the habitat originally given, we will have a type of generic distribution unique in the subfamily Obriminae, as no other member of that assemblage is known to occur in Australia.

²³ Named after the Igorrotes, the inhabitants of a section of the province of Nueva Vizcaya, Luzon.

the antero-lateral spines and a pair of small median tubercles. From *taylori* the present form may immediately be separated by the latter having the anterior margin of the mesonotum quadrituberculate, while in the former these structures are lacking.

Type.—♂; Imugan, Nueva Vizcaya, Luzon, Philippines. May 1, 1912. (W. Boettcher.) [Hebard Collection, Type no. 1292.]

Size relatively small for the genus; rather smooth except for the spines and tubercles on the head, pronotum and mesonotum.

Head longer than broad, narrowing posteriorly; eyes relatively large, convex, moderately prominent; occiput with lateral and median coronals spinoso-tuberculate, slightly anterior of median coronals is placed an additional pair of smaller tubercles; gular tubercles small; dorsal surface of head weakly granulose. Antennae relatively long (broken at sixteenth article), proximal article flattened, remaining articles more than twice as long as broad; all with numerous short, silvery hairs.

Pronotum longer than broad, slightly shorter than metanotum, not including median segment, gradually narrowing posteriorly; surface rugose, transverse sulcus weak, mesad; antero-lateral spinose tubercles relatively prominent, marginal tubercles small; posterior margin rugose, postero-lateral spines large, lateral margins with three small tubercles, mesal one smaller. Propleura not greatly expanded, extending laterad only slightly more than the notum. Prosternum of the usual type, broadly transverse, with the two inter-coxal raised sensory areas as in related species; general surface slightly rugose.

Mesonotum slightly more than twice as long as pronotum, subcylindrical, surface slightly rugoso-granulose, greatest length two and one-half times anterior width or twice posterior (greatest) width; anterior margin with four spaced spinose tubercles, lateral margins with an irregular series of tubercles. Mesopleura not expanded, not evident. Mesosternum rugoso-granulate with a series of lateral tubercles.

Metanotum rugose, slightly longer than pronotum, almost twice as long as broad. Median segment broadly transverse, rugose. Metapleura slightly expanded, their margins sparsely tuberculate. Metasternum rugoso-granulate.

Abdomen with dorsal surface rugose, ventral surface rugoso-tuberculate, broken at sixth segment; tergites 2 to 6 longer than broad.

Anterior femora as long as pro- and mesonotum, basal flexure present, marginal carinae present, dorso-anterior relatively prominent, ventro-posterior with two or three spaced tubercles in distal half. Anterior tibiae slightly shorter than femora, margins weakly carinate, covered with short hairs similar to those on antennae. Anterior tarsi moderately elongate, metatarsus slightly longer than second article, latter slightly longer than third, ultimate slightly shorter than first and second together, armed with relatively long and strong curved claws, pulvilli large, distinct; arolium present, about half as long as claws; tarsi with hairs as on the tibiae.

Median femora slightly shorter than anterior ones, slightly longer than mesonotum; marginal carinae not prominent, both ventral margins with a few spaced tubercles in distal half. Median tibiae slightly shorter than femora, marginal carinae weak. Tarsi much as anterior tarsi, but proximal article shorter.

Posterior femora longer than anterior ones, as long as meso- and metanotum together, carinae weak, ventro-anterior margin with scattered spinose tubercles for its entire length, ventro-posterior with spinose tubercles in distal half. Posterior tibiae and tarsi much as median tibiae and tarsi.

General color fuscous, ventral surface of thorax, femora and tibiae slightly lighter fuscous; ventral surface of abdomen blackish fuscous; tarsal claws very dark fuscous.

Length of body to end of sixth abdominal segment, 31.5 mm.; length of pronotum, 3; length of mesonotum, 7; length of metanotum, 3.8; length of median segment, 1.8; length of anterior femur, 9.5; length of median femur, 7-7.8; length of posterior femur, 10.8.

This species is known only from the male type.

Eubulides taylori ²⁴ new species

Plate 31, figs. 1, 2, 10.

This striking species differs from both the other Philippine members of the genus by lacking four large tubercles or a pair of antero-lateral spinose tubercles and a pair of small mesal tubercles on the anterior margin of the pronotum. The present insect differs from the other member of this genus (*spuria*) by having spinose lateral coronals on the occiput. The larger size of *taylori*, the more general smoothness, the absence of large spines and the dorsal specialization on the eighth and ninth abdominal tergites of the female sex will also readily separate this species from any of the other known forms of the genus.

Type.—♀; Polillo Island,²⁵ Philippines. (Taylor.) [Hebard Collection, Type no. 1251.]

General form large for the genus, body sparsely tuberculate; legs relatively short and rather stout.

Head with numerous relatively small tubercles of varying sizes, quite rough and granular, lateral and median coronals spinose, gulars small. Antennae incomplete, articles longer than broad, covered with erect silvery hair.

Pronotum relatively large, with numerous small tubercles but appearing much smoother than head; anterior margin with two small anterior mesal tubercles, posterior mesals smaller, these forming a rectangle, antero-laterals strongly spinoso-tuberculate; tubercles on rest of pronotum approximately the same size; at midpoint a weak transverse sulcus; in lateral view the outline of the posterior half of the pronotum is inclined upward posteriorly, postero-laterals very small, tuberculate; posterior margin slightly produced mesad with an obtuse angulation on the median line.

Mesonotum rather broad, with numerous short tubercles scattered irregularly over the surface, this portion of the body appearing about as roughened as pronotum; anterior margin with six small tubercles, the more

²⁴ Dedicated to its collector, Dr. Edward H. Taylor, to whose field work and laboratory studies we are indebted for much of the more recent elaboration of our knowledge of Philippine zoology.

²⁵ Polillo Island is twenty miles off the east coast of the island of Luzon (Province of Tayabas), separated by Polillo Strait. The meridians of 15° N. and 122° E. intersect at the northeast corner of the island.

lateral pair being larger. Pleura but moderately expanded, their margins with numerous irregular tuberculations, antero-laterals rather large, spinoso-tuberculate. Mesosternum with mesosternals small, tuberculate, also with a faint indication of a median carina present near the posterior margin.

Metanotum smooth except for the numerous irregular granulations. Pleura slightly expanded, lateral margins with a varying number of tubercles. Metasternum, much as mesosternum, with granules, a scattered arrangement of small tubercles and a faint indication of a median carina near the caudal margin. Median segment transverse.

Abdominal tergites 2 to 4 (including median segment in count) gradually broadening, 5 to 7 gradually narrowed, seventh with a slight indication of a pair of small tubercles meso-caudad; eighth tergite narrower, a briefly subfissate tubercle meso-posteriorly; ninth tergite with lateral margins very short, posterior strongly arcuate, tubercle larger than that on eighth, its apex subfissate; in lateral view these tubercles appear rostrate produced; penultimate tergite narrowed, with a median carina and its lateral margins arcuate, posterior margin truncate, ultimate tergite prolonged, slightly longer than the two preceding tergites, apex broadly rounded, with a definite median carina. Ventral surface of abdomen relatively smooth, a few scattered granules; operculum elongate, lanceolate, navicular, median carina strong, apex narrowly rounded, slightly surpassing that of ultimate tergite.

Anterior femora short, equal to slightly more than twice the length of the pronotum, relatively stout, basal flexure prominent on anterior surface, noticeable on posterior one, both anterior margins carinate, dorso-posterior weakly carinate, ventro-posterior carinate, with a few scattered tubercles and spines, the largest near the distal extremity. Anterior tibiae relatively smooth, all margins carinate. Anterior tarsi as in *igorrote*. Femora, tibiae and tarsi with short, erect, fuscous to blackish hairs.

Median femora slightly shorter than anterior femora, rather stout, somewhat inflated, all margins carinate, dorsal margins with a few small scattered tubercles, those on dorso-posterior in proximal half; ventral margins with a few scattered spines, largest near the distal extremity. Median tibiae practically smooth except for the slight denticulations on the extensor surface. Median tarsi as anterior tarsi except that the proximal article is somewhat shorter. Median limb, as a whole, with short erect hairs.

Posterior femora longer than median, almost as long as mesonotum, somewhat inflated, dorso-anterior margin weakly carinate, all other margins strongly carinate, dorso-posterior with scattered spines, longest and more numerous near distal apex, those on posterior margin more numerous and usually stronger. Posterior tibiae relatively smooth except for the slight denticulations of extensor surface. Posterior tarsi same as median tarsi. Posterior tibiae and tarsi with erect hairs.

Color on dorsum varying from light brown to reddish brown, ventral surface pale brown, except for mesosternum which is reddish brown, operculum at base dark brown, apex blackish; femora mostly pale brown, tibiae and tarsi slightly darker, tarsal claws black at apex.

Length of body, 92 mm.; length of pronotum, 6.8; length of mesonotum, 19; length of metanotum, 9; length of median segment, 4.3; length of anterior femur, 16; length of median femur, 14.4; length of posterior femur, 17.5.

Allotype.—♂; Same data as type. [Hebard Collection.]

Differing from the female holotype only in the following respects; the smaller size, the row of small gular tubercles not as prominent, on the pronotum there are no small posterior mesal tubercles, while the anterior margin of the mesonotum has but three or four tubercles instead of the six somewhat larger ones of the female. Abdominal tergites 2 to 7 (including median in count) gradually narrowed posteriorly, second tergite subquadrate, remainder longer than broad, eighth tergite slightly broader, its margins arcuate, ninth broadly transverse, seventh to ninth tergites slightly carinate, tenth tergite weakly bilobed. Poculum²⁶ slightly elongate, apical third carinate, apical margin with a flange. Legs as in the female except that the dorsal margins of the median femora are not tuberculate and the dorso-internal margin of the posterior femora have small tubercles instead of spines.

Color much as in female except that the dorsum is slightly lighter brown and the mesosternum is more reddish.

Length of body, 62.5 mm.; length of pronotum, 4.5; length of mesonotum, 14.2; length of metanotum, 7; length of median segment, 3.2; length of anterior femur, 11.5; length of median femur, 10.3; length of posterior femur, 13.8.

In addition to the type and allotype we have examined one male paratype, from the same locality, belonging to the United States National Museum, which agrees almost perfectly with the allotype, the only difference being its slightly smaller size.

THERAMENES Stål

1859. *Eurycantha* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., pp. 62-66. (In part.)

1875. *Theramenes* Stål, Rec. Orth., III, p. 46, footnote.

1904. *Theramenes* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Theramenes* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 37.

Genotype (by monotypy).—*Eurycantha olivacea* Westwood [= *Theramenes olivaceus* (Westwood)]²⁷

This genus, which is closely related to *Eubulides* Stål, is easily separable, in the male sex, from all the other members of this subfamily as both the meso- and metanotum each have a very large median tubercle. The females, however, are of the more usual Obrimini type, but differ from most others by not having definite spines on the mesonotum and metanotum, except on the anterior margin of the former; moreover, they differ from *Heterocopus* by having the operculum straight instead of curved. Both sexes of the

²⁶ Poculum is a name that we are using for the three apical sternites of the male. Because of their peculiar shape we believe that it is best to treat these three sternites collectively as a separate aggregation.

²⁷ Kirby (Syn. Cat. Orth., I, p. 339, (1904)) designated *Theramenes dromedarius* Stål as the genotype of *Theramenes*, which unfortunately is untenable, as Stål in describing *Theramenes* included solely *Eurycantha olivacea* Westwood. Moreover, *T. dromedarius* Stål was not described until two years after the genus was proposed. As a result *T. olivaceus* must be considered the genotype.

present genus differ from those of its closest relative, *Eubulides*, by having the flexor surface of the posterior tibiae serrate or spined distad instead of being relatively smooth. Moreover, the pleural margins of the meso- and metathorax are serrate instead of being smooth or weakly tuberculate.

The genus *Theramenes* is unknown to us except from the literature, but it presents certain problems. First, is that of the habitat of Westwood's *olivaceus*, which he said came from Ceylon; second, it would appear from a careful examination of the literature that Redtenbacher has misidentified Stål's *dromedarius*; third, Günther²⁸ has recently synonymized both of the previously known species. In that paper Günther, when recording material from Beo, Lobo and Salibabee in the Tulus²⁹ Islands, definitely synonymized Stål's *dromedarius* under *olivaceus* of Westwood, stating his belief, with which we agree, that the original locality of Westwood's species, i.e. "Ceylon", is erroneous. As to this synonymy there are very good grounds for a difference of opinion from Günther's interpretation. As stated above we feel that true *dromedarius* and *dromedarius* as understood by Redtenbacher, the latter one coming from the Tulus Islands, are distinct. There is no supportable evidence, at the present time, that Stål was incorrect in saying that his *dromedarius* came from the "Insulae Philippinae", as at present understood. There appears to us to be more warrant in believing that Stål's species is one occurring on some one of the Philippine Islands which has not been recognized since its description, than the assumption that his material was erroneously credited to the Archipelago as a whole. The comments made above express our definite belief that the "Talaar-Inseln" form examined and figured by Redtenbacher is distinct from *dromedarius* of Stål.

Unless evidence to the contrary is definitely forthcoming we must give weight to the original descriptions involved. Westwood states definitely, and his figure confirms, that the meso- and metanotal processes are not simple but bifid. Stål's *dromedarius* was said by its author to be very similar to *olivaceus*, and without mention of these processes to the contrary we are obliged to consider they are of similar character. Redtenbacher has recorded material from the Tulus Islands with bifid processes as *olivaceus*, and also other material from these islands with simple rounded processes, as described and figured by him, as *dromedarius* of Stål. Whether we have one, two or three species remains for future workers to determine.

²⁸ Sitzungsbr. Gesell. Naturforsch. Freunde, 1934, p. 75, (1934).

²⁹ The fauna of the Tulus Islands, which faunistically show little or no affinity with the Philippine Islands, was usually included in Bruner's catalogue. The spelling of the name of these islands is quite variable and some of the more common variants are: Tulour, Taleur, Talauer and Talaar.

***Theramenes olivacea* (Westwood)³⁰**

1859. *Eurycantha olivacea* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 65, pl. II, figs. 8, 8a, 8b. [♂; "Ceylon".]³⁰
 1875. [*Theramenes*] *olivacea* Stål, Rec. Orth., III, p. 46, footnote.³¹
 1904. [*Theramenes*] *olivacea* Kirby, Syn. Cat. Orth., I, p. 399.
 1906. *Theramenes olivacea* Redtenbacher, Insektenfam. Phasm., I, p. 37. [♂; "Talaur Inseln".]
 1915. *Theramenes olivacea* Bruner,³² Univ. Nebr. Studies, XV, no. 2, p. 228.
 1934. *Theramenes olivaceus* Günther, Sitzungsbr. Gesell. Naturforsch. Freunde, 1934, p. 75. [♂, ♀; "Beo, Lobo, Salibabee", Talaur Islands.] (In part.)

This species has the anterior pronotal tubercles present, the mesonotum has the lateral margins serrate with a pair of antero-lateral tubercles and a median anterior pair of the same; both the meso- and metanotum bearing a large conical bifid tubercle; mesosternum with paired lateral rows of small tubercles; posterior tibiae with flexor margin sparsely spined distad. The female of this species we feel remains unknown, not being that so recorded by Günther.

The known records of this species include both Ceylon and the Tulaur Islands and we feel that the latter locality is in all probability the correct habitat of this species.

***Theramenes dromedarius* Stål**

1877. *Theramenes dromedarius* Stål, Ann. Soc. Ent. Belg., XX, C.R., p. lxxviii. [♂; "Philippines".]
 1904. [*Theramenes*] *dromedarius* Kirby, Syn. Cat. Orth., I, p. 399.
 1906. *Theramenes dromedarius* Redtenbacher, Insektenfam. Phasm., p. 38, pl. II, figs. 2, 3, 3a, 3b. [♂, ♀; "Talaur-Inseln".]
 1915. *Theramenes dromedarius* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 228.
 1934. *Theramenes olivaceus*, Günther, Sitzungsbr. Gesell. Naturforsch. Freunde, 1934, p. 75. (In part.)

After a careful examination of all the literature bearing on this species we are convinced that more than one species is covered by the above references. Redtenbacher has, in all probability, misidentified Stål's species.

In Stål's characterization of *dromedarius* he said that it was very similar to *olivaceus* (Westwood) but differed from it by having conical tubercles on the latero-posterior angles of the pronotum, and the posterior margin of the second and third abdominal tergites strongly sinuate, while, as West-

³⁰ When Westwood described *olivacea* he gave Ceylon as the type locality but as the rest of the subfamily is more or less restricted to the Malayan region and South-eastern Asia it seems to us that the specimen was mislabelled. Also Redtenbacher (loc. cit.) records this species from "Talaur-Inseln" (Tulaur Islands), which is between the Philippine Archipelago and the northern portion of the Celebes group.

³¹ When Stål originally proposed the genus *Theramenes* he included only *olivacea* of Westwood, and referred to it only under Westwood's original combination, therefore, making no new combination.

³² In Bruner's "Preliminary Catalogue of the Orthopteroid Insects of the Philippine Islands" he included this species as from "Philippines, Talaaur Isls.", undoubtedly taking this from Redtenbacher's part I of the "Insektenfamilie der Phasmiden", but the Tulaur Islands politically are not part of the Philippine Archipelago, and faunistically show definite Celebean affinities. As a result this species has never been taken in the Philippines as here understood.

wood shows, *olivaceus* does not have the latero-posterior pronotal tubercles or the posterior margins of the second and third abdominal tergites strongly sinuate.

This species has been recorded from both the "Philippine Islands" and from the Tular Islands.

HETEROCOPUS Redtenbacher

1936. *Heterocopus* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 42.

Genotype (by present designation).—*Heterocopus leprosus* Redtenbacher.

The genus was erected for the species *H. leprosus* Redtenbacher and *Acanthoderus ranarius* Westwood without indication of a genotype. We here select the former, i.e. *H. leprosus*, as the genotype.

In relationship *Heterocopus* shows affinity to both *Eubulides* and *Theramenes*. As only the female sex of the present genus is known, we are forced to use sexual characters to separate it from its relatives. The genus *Heterocopus* differs from both *Eubulides* and *Theramenes* by having the operculum straight instead of curved, and the abdomen distinctly carinate, while both of the latter have only indications of a medio-longitudinal carina.

Heterocopus leprosus Redtenbacher

1906. *Heterocopus leprosus* Redtenbacher, Insektenfam. Phasm., I, p. 42, pl. I, fig. 7. [♀; "Pelew-Inseln".]

1915. *Heterocopus leprosus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

Although Bruner includes this species in his Philippine Catalogue it has never been taken in the Archipelago, as it is known only from the Pelew Islands.

STENOBRIMUS Redtenbacher

1906. *Stenobrimus* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 37.

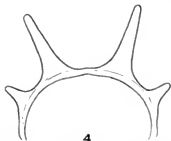
Genotype (by monotypy).—*Stenobrimus bolivari* Redtenbacher.

This genus is quite distinct from all the other genera of this subfamily. It is most closely related to *Aretaon*, but differs in its general build as it is slim and quite elongate, both sexes being more slender than those of any of the other genera. From *Aretaon* the present genus may be separated by having simple paired posterior meso- and metanotal spines, smooth tibiae, lacking a distinct medio-longitudinal dorsal carina (in the adult), and the short operculum not surpassing the supra-anal plate; instead of having the paired posterior meso- and metanotal spines compound, the tibiae either serrate or spined on some of their margins, the medio-longitudinal carina weak on the thorax, more prominent and with spines or foliaceous dentations on the abdomen and the operculum elongate, surpassing the supra-anal

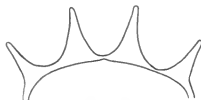
plate. From *Obrimus*, which has marginal folds on the metasternum, smooth to sparsely spined femora, and a very weak medio-longitudinal carina, *Stenobrimus* differs by lacking marginal folds on the metasternum, and the medio-longitudinal carina is lacking.

Key to Species

1. Proximal abdominal tergites with first and second paired posteriors of practically the same size, or with first paired posteriors slightly longer; these tergites with definite lateral and median carinae proximad; gulars weakly spinose *bolivari* Redtenbacher
- Proximal abdominal tergites with second paired posteriors small, sub-obsolete, first paired posteriors large, strong, at least twice as long as second paired posteriors, these tergites without definite lateral and median carinae, gulars weakly tuberculate *tagalog* new species



4



5

TEXT-FIGURE 4.—*Stenobrimus tagalog* new species. Diagrammatic cross section through anterior portion of abdomen of male (type). Polillo Island. (Greatly enlarged.)

TEXT-FIGURE 5.—*Stenobrimus bolivari* Redtenbacher. Diagrammatic cross section through anterior portion of abdomen of female. Mount Banahao, Luzon. (Greatly enlarged.)

Stenobrimus bolivari Redtenbacher

Text-figure 5.

1906. *Stenobrimus bolivari* Redtenbacher, Insektenfam. Phasm., I, p. 37, Pl. I, figs. 1, 1a. [♀; "Philippinen, Tayabas".]

1915. *Stenobrimus bolivari* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 228.

The female specimens before us, which appear to be in the instar preceding maturity, agrees closely with Redtenbacher's original description. However, the following information concerning them may be of some value.

General form elongate. Head longer than broad, narrowing posteriorly, vertex granuloso-tuberculate, occiput subconically produced, with two posteriorly convergent rows of spines, the first pair of these being large, followed by another pair of spines then a larger pair followed by another smaller pair, the four largest being the four occipital spines of Redtenbacher's description; gulars spinose, weak. Proximal antennal article one and one-half times as long as broad, somewhat flattened, with a few hairs; second article shorter and more slender, remaining articles elongate, rectangular, much longer than broad.

Pronotum twice as long as median segment, one and one-half times as long as broad, anterior spines large, posteriors smaller, these paired spines connected by a row of small spinose tubercles; lateral margins in posterior half with or without spinose tubercles. Propleura somewhat expanded above the coxae. Prosternum of the usual type, transverse, with the usual intercoxal raised sensory areas.

Mesonotum elongate, three times as long as pronotum, lateral margins subequally parallel anteriorly and posteriorly, and slightly arcuate expanded in median third; anterior, median and posterior spines large, from posterior spines to posterior margin a row of small spinose tubercles; large lateral tubercles slightly posterior of median paired spines and sometimes with large lateral spines behind anterior; dorsum spinoso-granulate, lateral margins spinoso-tuberculate. Mesopleura expanded above the mesocoxae, with two large spines and several smaller spinose tuberculations. Mesosternum with a medio-longitudinal carina which is tuberculate, inter-coxally with a low rounded postero-sternal tubercle. Meso- and metanotum with a medio-longitudinal carina.

Metanotum relatively long, a little more than half as long as the mesonotum; anterior, antero-lateral and posterior spines large, from posteriors to posterior margin a row of small spinose tubercles; lateral margins at proximal third with a large spine, remainder of lateral margin sparsely spinoso-tuberculate. Median segment transverse, posterior mesal spine strong and with small lateral spines. Metapleura and metasternum as those portions of the mesothorax.

Abdomen with the tergites longer than broad, rectangulate, tergites 2 to 5 strongly quadrispinose at posterior margin, tergites 6 to 9 weakly quadrispinose; abdomen with a medio-longitudinal and paired lateral carinae; lateral margins of tergites 2 to 4 with small spinose tubercles; eighth and ninth tergites with foliaceous expansions on the posterior portions of the carinae; sterna with a medio-longitudinal carina, sparsely granulose. As neither of the specimens are adult we are not describing the apex of the abdomen.

Anterior femora as long as pro- and mesonotum, all margins carinate, posterior ones foliaceous dentate. Anterior tibiae slightly shorter than femora, their margins simple. Anterior tarsi with proximal article elongate, slightly shorter than remainder of tarsus, other articles short, ultimate slightly longer than two preceding articles; claws, pulvilli and arolia of the usual type for the tribe.

Median femora shorter, slightly longer than mesonotum, all margins carinate, both dorsal and the ventro-posterior margins with foliaceous dentations, ventro-anterior with a dentation near distal apex. Tibiae and tarsi as in anterior limb.

Posterior limb the same as the median except for foliaceous dentations on ventro-posterior margin and the slightly larger size, the femora being as long as the pro- and mesonotum.

General color of dorsum a faded mytho green ranging to light olive ocher; ventral surface and limbs ecru olive. Dorsal surface with area around base of mesonotal anteriors and medials warm sepia, the immediate post-median fourth of mesopleura and posterior fourth of mesonotum with an inverted chevron-shaped band of warm sepia. Metanotum with inverted, chevron-shaped band on posterior half and on anterior two-thirds of metapleura, usually warm sepia. The exact extent and outline of these darker areas is quite variable.

The largest of these immature females agrees almost exactly with the measurements given by Redtenbacher for what he considered an adult female.

The immature male differs from the female only in the following character:

Vertex with only four large spines, posterior spines of pronotum slightly larger than those of the female, mesonotum lacking large lateral tubercles, a pair of small lateral tubercles behind median paired spines, metanotum with antero-laterals very small, tuberculate.

General color of body the same as in the female but the warm sepia markings are absent on the meso- and metapleura, and they are confined to lateral stripes on the immediate post-median fourth of the mesonotum and on the median third of the metanotum.

This striking species is known from the provinces of Tayabas and La Laguna, Luzon, and is in all probability a mountain form.

Specimens examined.—3; 2 juv. ♀, 1 juv. ♂.

LUZON: Mt. Banahao,³³ north-west Tayabas, elevation 975 meters; March 21, 1934; (G. A. Pangga); 1 juv. ♀; [A.N.S.P.]. Majayjay, La Laguna; May 1929; (R. E. McGregor); 1 juv. ♀; [U.S.N.M.]. Ube, La Laguna, April 1930; (R. C. McGregor); 1 juv. ♂; [U.S.N.M.].

Stenobrimus tagalog ³⁴ new species Text-figure 5; plate 31, fig. 11; pl. 38, fig. 46.

This species is closely related to, but readily separable from *bolivari*, the only other species of the genus, by its more slender form, the less strongly serrate femora, the first paired posterior spines of the proximal abdominal tergites being more than twice as long as the second paired posteriors of these tergites, which lack definite lateral and median carinae, while the gulars are weakly tuberculate, as contrasted with *bolivari* in which the first and second paired posteriors of the proximal abdominal tergites are practically the same size, these tergites having definite lateral and median carinae, and the gulars weakly spinose.

Type.—♂; Polillo Island, Philippines. (Taylor.) [Hebard Collection, Type no. 1295.]

General form elongate, slender, head with spination much like that of *bolivari*, occiput subconically produced with four large spines, gulars weak, tuberculate.

Pronotum slightly less than twice as long as median segment; anterior spines large, distal one compound, posterior spines small, practically sub-obsolete, these paired spines connected by a row of small tubercles; lateral margins simple.

Mesonotum greatly elongate, more than four times as long as greatest width which is equal to length of pronotum; lateral margins subparallel; anterior, median and posterior spines large, medians staggered, a single

³³ This locality was spelled Mt. Banahao on the specimen and in the 1918 Census of the Philippines report, but the spelling Mt. Banajao is used in both the United States Coast and Geodetic Survey's Special Publication No. 3, Atlas of the Philippine Islands, and in the Gazetteer of the Philippine Islands.

³⁴ Named after the Tagálogs who are the inhabitants of most of the central provinces of Luzon.

pre-median on dextral side, lateral margin granuloso-tuberculate. Mesopleura expanded above the coxae with two large spines. Mesosternum with a medio-longitudinal rugose ridge which is broadened inter-coxally.

Metanotum elongate, slightly more than half as long as mesonotum; anterior and posterior spines large. Median segment with posterior mesal spine strong. Metapleura and metasternum as those portions of the mesothorax.

Abdomen with tergites 2 and 7 twice as long as broad, 3 to 6 more than twice as long as broad; tergites 2 to 4 with first paired posterior spines strong, more than twice as long as second paired posteriors, which are sub-obsolete; penultimate tergite with a median node near posterior margin, ultimate tergite at apex broadly bilobed; poculum, in lateral view, semi-subovoid, with a distinct median carinate keel, at posterior fourth a pair of raised tubercles, whole process terminated in a distinct lip. Cerci simple, shaft-like.

Anterior femora elongate, slender, slightly less than the length of meso- and metanotum; all margins slightly carinate; dorsal margin with three or four low, spaced, adpressed serrations. Anterior tibiae slightly longer than femora, their margins carinate. Anterior tarsi elongate, basal article longer than remaining ones, second slightly longer than third, third slightly longer than fourth, ultimate as long as third and fourth together; claws elongate, not strongly curved.

Median femora slightly shorter than anterior ones, slightly longer than pro- and mesonotum; their margins carinate, dorsal margins with low, spaced, serrations which are either adpressed or subfalcate, ventral margins with a pair of pre-apical serrations. Tibiae and tarsi as those of anterior limbs.

Posterior femora as long as meso- and metanotum, serrations as on median femora. Tibiae and tarsi much as those of anterior limbs.

Length of body, 58 mm.; length of pronotum, 3; length of mesonotum, 13.5; length of metanotum, 8.5; length of median segment, 1.9; length of anterior femur, 20.5; length of median femur, 17.5; length of posterior femur, 21.5.

General color ochraceous tawny with pleura, lateral portions of sterna, lateral portions of meso- and metanotum and terminal abdominal segments varying from chestnut brown to blackish. Large spines dull empire-green. Legs blackish.

In addition to the type we have before us two immature males with the same data. These individuals show practically no variation except that the spines seem slightly more prominent, the body slightly more rugose, and the carinations and serrations of the femora are more prominent.

This species is known only from Polillo Island, while its relative *bolivari* is known from two provinces of Luzon.

ARETAON³⁵ new genus

1877. *Obrimus* Stål, Ann. Soc. Ent. Belg., XX, C. R., p. lxxviii. (In part.)
1904. *Obrimus* Kirby, Syn. Cat. Orth., I, p. 398. (In part.)
1906. *Obrimus* Redtenbacher, Insektenfam. Phasm., I, pp. 38-42. (In part.)
1915. *Obrimus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229. (In part.)

³⁵ From 'Ἀρετάων a Trojan warrior.

Genotype (by present designation).—*Obrimus asperrimus* Redtenbacher [= *Aretaon asperrimus* (Redtenbacher)].

This genus which is closely related to *Obrimus*, *Euobrimus* and *Brasidas* contains two definite subgenera. From the above-mentioned genera *Aretaon* differs by lacking metasternal pseudo-foramina, or a marginal fold. Moreover, in all the members of this assemblage the anterior paired pronotal spines are strong, the posterior meso- and metanotal spines are strongly composite, and all of the abdominal tergites have a posterior mesal spine or foliaceous dentation, while in the other related genera metasternal pseudo-foramina, or marginal folds are present, the anterior pronotal spines are either absent or they are reduced to very small tubercles, the posterior meso- and metanotal spines are not strongly composite except in *Brasidas* and in one species of *Euobrimus*, and only on the posterior third of the abdomen do the tergites have a posterior mesal spine or specialization. From *Stenobrimus* the present genus may be separated by having the posterior meso- and metanotals composite, the operculum elongate and curved upward, in lateral aspect, the medio-longitudinal carina weak on the thorax and more prominent on the abdomen and the general form is rather stout, while in *Stenobrimus* the posterior meso- and metanotals are not composite, the operculum is short and straight, the medio-longitudinal carina absent and the general form quite elongate and slender.

Generic characters.—General form relatively broad, strongly spinose. Occiput with eight or more spines. Pronotum with anterior spines strong, prominent; posterior pronotal spines lateral, much smaller than anterior; prosternum transverse, with inter-coxal raised sensory areas. Mesonotum with anterior spines strong, in females with either a median pair of spines or a crown of four spines, in males medianly unarmed or with a pair of spines, posterior spines strongly composite. Metanotum with posterior spines strongly composite. Median segment and all abdominal tergites with a posterior mesal spine or foliaceous dentation; abdominal tergites somewhat expanded laterad.

Key to Subgenera and Species

1. Pronotum lacking definite inter-posterior spines, lacking anterior mesal metanotal spines; females having only the posterior mesal spinose tubercle on the median segment, with paired median mesonotals; males lacking median mesonotals. (*Aretaon* sensu strictiore) 2
- Pronotum with definite inter-posterior spines and with anterior mesal metanotal spines; females having anterior mesal spines on median segment and a crown of four median mesonotal spines; males with median mesonotals. (*Trachyaretaon* new subgenus) .. *echinatus* (Stål)
2. Extensor surface of anterior tibiae relatively smooth, with at most a few low tubercles; abdominal tergites 1 to 5, at least, with a large posterior mesal spine *asperrimus* (Redtenbacher)
- Extensor surface of anterior tibiae serrate or foliaceous-serrate in basal half; abdominal tergites 1 to 8, especially 4 to 8, with a medio-longitudinal subtriangular area which is cut off by lateral and posterior spines or foliaceous-serrations *muscosus* (Redtenbacher)

ARETAON *sensu strictiore*

Genotype (by present designation).—*Obrimus asperimus* Redtenbacher [= *Arctæon (Arctæon) asperimus* (Redtenbacher)].

This, the typical, subgenus is limited to *Obrimus asperimus* Redtenbacher and *Obrimus muscosus* Redtenbacher. The members of it differ from those of *Trachyaretaon* by lacking definite inter-posterior pronotal spines and the anterior mesal metanotal spines, both of which are present in the latter subgenus. The females of restricted *Arctæon* have a posterior mesal spine or spinose tubercle, a pair of median mesonotal spines and the abdominal tergites have the lateral margins of the posterior third armed with a spinose tubercle instead of having paired anterior pronotal spines, a full posterior series on the median segment, a crown of four median mesonotal spines, and abdominal tergites with their lateral margins foliaceously expanded and without a spinose tubercle as is the case in *Trachyaretaon*. In the males of *Arctæon* there is only a posterior mesal spine on the median segment, and they lack paired median mesonotal spines, while in that sex of *Trachyaretaon* the median segment has the full posterior series and there is a pair of median mesonotal spines.

Subgeneric characters.—General surface granulose and with numerous large spines. Occiput with eight spines arranged in two occipital median rows of three and including the median coronals and lateral coronals, gulars weak. Prothorax as described under the genus, lacking interposteriors. Mesonotum with dorsal spines as described under the genus, having only the paired medials; lateral margins granuloso-tuberculate; mesopleura evident, with four or five relatively small lateral spinose tubercles, mesopleural spine relatively large; mesosternals small, tuberculate, in two irregular lateral rows. Metanotum with posteriors strongly composite, lacking anterior mesals, metapleura with one to three laterals, supra-coxals strong, composed of two or three main spines; metasternum with metasternals granulose. Abdomen with either a posterior mesal spine on tergites 1 to 6 and with serrato-dentations postero-mesad, or with the full posterior series. Femora above with spaced serrato-dentations.

Arctæon (Arctæon) asperimus (Redtenbacher)

1906. *Obrimus asperimus* ³⁶ Redtenbacher, Insektenfam. Phasm., I, pp. 39, 41, 42, pl. I, figs. 4, 4a, 5, 5a. [♂, ♀; "Kina-Balu, Borneo".]

1910. *O[brimus] asperimus* Dohrn, Stett. Ent. Zeit., 1910, p. 398.

This species has not previously been reported from the Philippines, but the example here recorded appears to be perfectly typical of Redtenbacher's *asperimus*, which was described from northern Borneo. This female agrees perfectly with the original description and also with additional available material.³⁷ However, all these individuals appear slightly less strongly

³⁶ Redtenbacher has consistently used this spelling, except on page 41 where he uses *asperimus*.

³⁷ We have examined in this connection two females and one male, in the Hebard Collection, from Labuan, British North Borneo, which agree in all respects with the Philippine specimen.

spinose than the figures given by Redtenbacher, but allowing reasonable license to the artist who prepared the drawings they essentially agree with the illustration.

The present species may be separated from *muscosus*, the only other member of this subgenus, by having at least the first five abdominal tergites with a large posterior mesal spine, instead of having on segments 1 to 8, and particularly on 4 to 8, a medio-longitudinal subtriangular area which is cut off by lateral and posterior spines or foliaceo-serrations. Moreover, in *asperrimus* the extensor surface of the anterior tibiae is relatively smooth, having at most a few low tubercles, instead of this surface being serrate or foliaceo-dentate, particularly in the basal half.

This species has now been recorded from Kina-Balu, North Borneo, Labuan and from the Province of Benguet, Luzon, and it seems to us that this is an example of the Philippine influence in the Bornean fauna, as the Obrimini are basically a Philippine stock.

Specimens examined.—1; 1 ♀.

LUZON: Baguio, Benguet; (G. G. Haslam); 1 ♀; [U.S.N.M.].

Aretaon (Aretaon) muscosus (Redtenbacher)

1906. *Obrimus muscosus* Redtenbacher, Insektenfam. Phasm., I, pp. 39, 41. [♂, ♀; "Kina-Balu, Borneo".]

LABUAN: 2 ♀; [Hebard Cln.].

This material agrees perfectly with the original description as to color and structure, but both specimens are somewhat smaller than the measurements given by Redtenbacher. This may be due to Labuan material averaging smaller than specimens from the main island of Borneo. The species is inserted in the present paper to show its relative position.

TRACHYARETAON³⁸ new subgenus

Genotype (by present designation).—*Obrimus echinatus* Stål [= *Aretaon (Trachyaretaon) echinatus* (Stål)].

This subgenus, which includes only *Obrimus echinatus* Stål, is closely related to true *Aretaon*, but differs from it by having interposterior pronotal spines and the anterior mesal metanotal spines strong and the femoral margins above strongly serrate, instead of lacking both of these sets of spines and having the femoral margins above with, at most, serratodentations.

³⁸ *παχὺς*, i.e. rough + *Aretaon*.

Subgeneric characters.—Head with supra-antennals and supra-orbitals, occipital medials generally three, median longest, lateral and mesal coronals present, gulars weak, dorsal surface of head smooth to granulose. Pronotum much as described under the genus but with definite inter-posteriors. Mesonotum with the laterals spinose, in the female with a crown of four medials, in the male with a pair of medials; mesopleural laterals with a single strong series, supra-coxals relatively small, not prominent; mesosternals present, relatively prominent. Metanotum much as described under the genus but with anterior mesals and inter-posteriors well developed; metapleura with laterals and supra-coxals relatively long and prominent. Median segment with anteriors and a full posterior series; on basal abdominal segments a posterior mesal spine and on remaining segments a foliaceous dentation, meso-laterals and laterals present on at least tergites 2 to 8. Femoral margins above strongly serrate.

Areataon (Trachyareataon) echinatus (Stål)

Plate 32, fig. 13.

1877. *Obrimus echinatus* Stål, Ann. Soc. Ent. Belg., XX, C.R., p. lxxviii. [♀; "Insulae Philippinae."]

1904. *O[brimus] echinatus* Kirby, Syn. Cat. Orth., I, p. 398.

1906. *Obrimus echinatus* Redtenbacher, Insektenfam. Phasm., I, pp. 39-41. [♀; "Manila."]

1915. *Obrimus echinatus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

1933. *Obrimus echinatus* Sjöstedt, Arkiv för Zoologi, 25a, no. 16, p. 2.

The specimens before us agree with Stål's description of this distinctive species, and for the information of future workers the following comparison may be found helpful. It is readily separable from the other members of this genus by the female having a crown of four median mesonotal spines instead of a single pair; the median segment has a well developed pair of anteriors instead of these being lacking; and the inter-posteriors of the pronotum are well developed instead of being absent.

The immature male is referred to this species with some doubt; as it is so small that the characters are not well developed, it is thus inadvisable to describe it.

This species is at present known from four localities in three of the Philippine Islands, namely Manila and Mt. Banahao in Luzon, Sibuyan and Masbate.

Specimens examined.—4; 3 juv. ♀, 1 juv. ♂.

LUZON: Mt. Banahao,³⁹ N. W. Tayabas; April 30, 1914; (W. Boettcher); 1 juv. ♀; [Hebard Collection]; Elev. 500 meters; March 23, 1934; (V. J. Madrid); 1 juv. ♀; [Philippine College Agric.].

MASBATE: January 10, 1912; (W. Boettcher); 1 juv. ♂; [Hebard Cln.].

SIBUYAN: (Baker); 1 juv. ♀; [Hebard Cln.].

³⁹ Both of the specimens before us cite this locality with different spelling, one using simply "Banahao" and the other "Mt. Bananao". However, it seems quite evident that these spellings, as well as "Banajao", are for the same locality.

OBRIMUS Stål

1875. *Obrimus* Stål, Rec. Orth., III, pp. 49, 92.1895. *Acanthoderus* Elera, Fauna Filipinas, II, p. 200.1904. *Obrimus* Kirby, Syn. Cat. Orth., I, p. 398.1906. *Obrimus* Redtenbacher, Insektenfam. Phasm., I, p. 38.

Genotype (by designation of Kirby, 1904).—*Acanthoderus bufo* Westwood [= *Obrimus bufo* (Westwood)].

This genus is related to *Aretaon*, *Brasidas* and *Euobrimus* but differs from all of these by the character of the metasternum, as in *Obrimus* there are distinct marginal folds, while in *Brasidas* there are semi-cingulate fossae, in *Euobrimus* there are completely cingulate pseudo-foramina and in *Aretaon* there are no specializations of the metasternum.

General characters.—General size moderately large, quite spiny, resembling the other closely related genera (*Brasidas* and *Euobrimus*); mesosternum with mesosternals (at least in the female sex); metasternum with distinct marginal folds; limbs with margins dentate; posterior pro-, meso- and metanotals present, usually well developed, median mesonotals present, laterals of meso- and metathorax of the females usually quite numerous and prominent, the male sex lacks these laterals, median segment with medials present, tuberculate or spinose; proximal abdominal tergite with either anteriors or antero-laterals and medials or first paired posteriors present, also other spines present on most of the body.

Key to Species

1. Anterior pronotal spines definite; inter-posterior spines of the pronotum distinct 2
 Anterior pronotal spines rudimentary or absent, inter-posterior pronotal spines sub-obsolete or absent 3
2. Occiput with four large spines (occipitals and median coronals); proximal abdominal tergites without first and second paired posteriors.
 bufo (Westwood)
- Occiput with six large spines (median, lateral coronals and occipitals); proximal abdominal tergites with small first and second paired posteriors*uichancoi* new species
3. Proximal abdominal tergites with six spines, anteriors and posterior quadrangle; lateral coronals larger than median coronals.
 mesoplatus (Westwood)
- Proximal abdominal tergites with nine spines or spinose tubercles, latero-ant anteriors, medials and a full posterior series; lateral and median coronals subequal*bicolanus* new species

The males of *bufo*,⁴⁰ *uichancoi* and *bicolanus* and the female of *mesoplatus* are not known.

⁴⁰ Westwood in his original description of *O. bufo* states that he has a male which differs from the female only in its lesser length and width, and has the spines arranged as in the female. Through the kindness of Mr. B. P. Uvarov we now know that this is an immature female. For a discussion of this see comments under *O. bufo*.

Obrimus bufo Westwood

1848. *Phasma* (*Acanthoderus*) *bufo* Westwood, Cab. Orient. Ent., p. 77, pl. XXX-VIII, fig. 3. 1 ♀, ♂; "Philippine Islands."]
1859. *Acanthoderus bufo* Westwood,⁴¹ Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 51, pl. II, figs. 6, 6a, 6b, 6c. (In part.)
1875. *Obrimus bufo* Stål, Rec. Orth., III, p. 92.
1895. *A[canthoderus] bufo* Elera, Fauna Filipinas, II, p. 200.
1904. *O[brimus] bufo* Kirby, Syn. Cat. Orth., I, p. 398.
? 1936. *Obrimus bufo* Redtenbacher,⁴² Insektenfam. Phasm., I, p. 40. (In part.)
1915. *Obrimus bufo* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

This, the genotypic species (*bufo*), has usually been misidentified. It is characterized by the presence of definite anterior pronotal spines and small but distinct inter-posterior ones, while in all the other species except *uichancoi* the anterior pronotal spines are either rudimentary or absent, and the inter-posterior ones are either subobsolete or absent. From *uichancoi* the present species is readily separable by the character of the head and abdominal spination; on the former the lateral coronals are strong, and the proximal abdominal segments have small first and second paired posterior spines and the medials are but moderately developed, while in *bufo* the lateral coronals are subobsolete and the proximal abdominal tergites lack the first and second paired posteriors, but they do have relatively strong post medials; in *bufo* the median femora are slightly shorter than the mesonotum, and the posterior femora reach to approximately the middle of the sixth abdominal tergite, while in *uichancoi* the median femora are slightly longer than the mesonotum and the posterior femora reach to the middle of the fifth tergite.

Westwood, when he described this species, chiefly from the female, said that he also had a male, but through the kindness of Dr. B. P. Uvarov we have found that this specimen is an immature female. Such being the case the present species is known only from the female sex.

This species is not known from any definite locality, being described originally from the "Philippine Islands", and Redtenbacher records his material of this species from "Philippines, Manila". As the latter's concept is a composite one we cannot be sure which portion of his material came from Manila.

⁴¹ Westwood in his catalogue reprints his original description of *bufo*, but figures an immature female of a different species. The figured specimen differs from all the known species of *Obrimus* by a combination of characters. It lacks anterior pronotal spines and the spination on the proximal abdominal tergites differs from that found in other members of this genus.

⁴² Redtenbacher's *bufo* is quite evidently composite, as his male appears to be Westwood's *mesoplatus*, while his female might be either *bufo* or *uichancoi*. Due to his indefinite description and lack of detailed distributional information it is impossible, without examination of his specimens, to place his material definitely.

Obrimus uichancoi ⁴³ new species Plate 31, fig. 7; pl. 32, fig. 14; pl. 38, fig. 42.

? 1906. *Obrimus bufo* Redtenbacher,⁴⁴ Insektenfam. Phasm. I, p. 40. (In part.)

This new species, which is most closely related to *bufo*, differs from it by the lateral coronals being strong, the proximal abdominal tergites having small but definite first and second paired posteriors and moderately strong medials, while in *bufo* the lateral coronals are subobsolete and the proximal abdominal tergites lack both the first and second paired posterior spines and have definite postmedials. Moreover, the median femora of *uichancoi* are somewhat longer than the mesonotum and the posterior femora reach but to the middle of the fifth abdominal segment, while in *bufo* the median femora are slightly shorter than the mesonotum and the posterior femora reach to the middle of the sixth abdominal segment.

Type.—Juv. ♀; Ripang,⁴⁵ Apayao Subprovince, Mountain Province, Luzon, Philippines. February 1918. (W. Boettcher.) [Hebard Collection, Type no. 1296.]

General size moderate for the genus, moderately heavy and quite spiny and tuberculate, general surface more or less rugose.

Head elongate, rectangulate, approximately twice as long as wide; eyes very large and prominent, globose, supra-orbitals, median and lateral coronals and occipitals relatively large spinose-tuberculate, also a somewhat smaller pair laterad of lateral coronals; general surface with scattered low tubercles and granules; antennae long filiform, two basal articles heavier, all with numerous short hairs.

Pronotum subquadrate, slightly longer than wide, somewhat more than a third as long as mesonotum; posterior pronotals strong, spiny, medials about half as large as posteriors, antero-laterals small, meso-posterior of posteriors a pair of low tubercles, and a paired longitudinal row of tubercles from medials almost to posterior margin; anterior coxae with three prominent spines two on distal margin, one inner and one external, third spine much smaller along external margin behind distal one.

Mesothorax with mesonotum elongate, subrectangular, somewhat over twice as long as greatest width; anteriors, pre-laterals and premedials relatively large, spiny, posteriors relatively prominent, cristate, but very weakly compound. Mesopleura with laterals rather strong, supra-coxals weak, meso-pleural simple, relatively strong. Mesosternum with median carina faint with mesosternal rows present and spinoso-tuberculate, a low postero-sternal swelling.

Metathorax with metanotum, excluding median segment, more or less subquadrate, approximately half as long as mesonotum; with posterior mesonotals low, slightly compound, remainder of metanotum with scattered low tubercles. Median segment broadly transverse, medials more or less spinose, and a full posterior series of tubercles. Metapleura with antero-laterals, a few supra-coxals and meta-pleural all more or less spinose,

⁴³ It gives us great pleasure to name this species after Prof. L. B. Uichanco, of the Philippine College of Agriculture, in appreciation of his cooperation in loaning material for this study.

⁴⁴ See footnote 42.

⁴⁵ This locality is given as a rancheria of the Apayao Subprovince, in the 1918 Census of the Philippine Islands, and its exact location is 17° 48' N., 121° 19' E.

remainder with scattered tubercles. Metasternum with shallow, broad marginal folds, along inner margin of fold a few low tubercles, postero-lateral margin with a rather prominent spinose tubercle.

Abdomen with tergites broadly transverse, proximal tergites with latero-anteriors spinose, first and second paired posteriors tuberculate, near lateral margin slightly behind middle a tubercle, laterad of medio-longitudinal line, which is weakly indicated proximad but more strongly so distad, a row of tubercles more prominent at posterior third; lateral margins with posterior portion progressively expanded from tergite 3 to ultimate tergite; median carina progressively stronger throughout length, more so near posterior margin of each tergite, 5 to 7 with a tubercle or spine at this point, 8 with a subtrigonal lobe and 9 with a subrostrate lobe; penultimate tergite with posterior margin more or less arcuate, feebly emarginate mesad; ultimate tergite slightly shorter than penultimate, median carina distinct, lateral margins slightly and evenly convergent to posterior margin which is shallowly concave; sternites with a median and a pair of lateral carinae, these with a few scattered tubercles, toward posterior extremity numerous folds.⁴⁶

Anterior femora relatively heavy, somewhat longer than mesonotum, basal flexor quite weak, all four margins except for basal portion of ventro-anterior with spaced serrations, ventro-anterior margin with an indication of a carina proximad, and a few low tubercles; anterior tibiae with low, scattered, spaced serrations, tarsi missing.

Median and posterior limbs with margins of both femora and tibiae with serrations, tarsi as usual for the group; median femora slightly longer than mesonotum, posterior femora as long as pro- and mesonotum.

General color snuff-brown, with patches of clay color on meso- and metanotum, abdomen slightly darker than rest of body, venter mostly clay color, limbs mottled with clay color, tarsi dark fuscous.

Measurements: Length of body, 62 mm.; length of pronotum, 4.5; length of mesonotum, 10.5; length of metanotum, 5.5; length of median segment, 3.2; length of anterior femur, 12; length of median femur, 10; length of posterior femur, 13.8.

We have before us several immature individuals of this species representing various instars, and the characters given above are present in all of these. Also we have one very young male of this species, but, as it is so immature, we do not feel that it would be advisable to describe it. However, in the more essential features it agrees closely with the females.

Specimens examined.—8; 7 juv. ♀, 1 juv. ♂.

Luzon: Ripang;⁴⁷ Apayao Subprovince, Mountain Province; February 1918; (W. Boettcher); 6 juv. ♀ (including type); [Hebard Cln.]. Los Banos; November 20, 1915; (C. S. Banks); 1 juv. ♀; [Philippine Coll. Agr.]. Binay;⁴⁸ March 17, 1916; (W. Boettcher); 1 juv. ♂; [Hebard Cln.].

⁴⁶ We do not think it advisable to give a more detailed description of the apex of the abdomen as the specimen is immature.

⁴⁷ See footnote 45.

⁴⁸ This locality is in Tayabas Province, situated 13° 30' N., 122° 35' E. On the original Boettcher labels it appeared as "Vinai".

Obrimus mesoplatus (Westwood)

1848. *Phasma* (*Acanthoderus*) *mesoplatum* Westwood, Cab. Orient. Ent., p. 77, pl. XXXVIII, fig. 4. [♂; Philippine Islands.]
 1859. *Acanthoderus mesoplatus* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 51.
 1875. *Darcs mesoplatus* Stål, Rec. Orth., III, p. 94.
 1904. *O[brimus] mesoplatus* Kirby, Syn. Cat. Orth., I, p. 398.
 1906. *Obrimus mesoplatus* Redtenbacher, Insektenfam. Phasm., I, p. 40.
 1915. *Obrimus mesoplatus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

This species is apparently more closely related to *bicolanus*, here described, than to any other species of the genus. Both *mesoplatus* and *bicolanus* differ from the other species of the genus by having the anterior pronotal spines either rudimentary or absent, and the inter-posterior pronotal spines are either subobsolete (*bicolanus*) or absent (*uichancoi*). Westwood's *mesoplatus*, which is known only from the male sex, differs from *bicolanus* by having six spines on the proximal abdominal tergite, these being anteriors and a posterior quadrangle, instead of having nine spines or spinose tubercles as in the latter species.

This little known form of the genus has not been reported since Westwood's original description, and we also lack information on the exact locality in the Philippines where it occurs.

Obrimus bicolanus new species

Plate 32, fig. 15; pl. 38, fig. 41.

The present species is closely related to *mesoplatus* but differs from it in the armament of the proximal abdominal tergites. From the other forms of the genus except *mesoplatus*, *bicolanus* differs by lacking the anterior pronotal spines and having the inter-posterior spines subobsolete. From *mesoplatus*, *bicolanus* differs by having nine spines or spinose tubercles on the proximal abdominal tergites, the latero-anteriors, medials, and a full posterior series; instead of having only six spines on these tergites, the anteriors and a posterior rectangle. Moreover, in *bicolanus* the lateral and median coronals are subequal, while in *mesoplatus* the lateral coronals are larger than the median ones.

Type.—Juv. ♀; Bulusan, Sorsogon, Luzon, Philippines. September 1918. (W. Boettcher.) [Hebard Collection, Type no. 1297.]

General size relatively large for the genus, moderately heavy, quite spiny and with numerous tubercles, general surface granular to tuberculate.

Head elongate rectangular, slightly less than twice as long as wide, eyes relatively large and rather prominent, more or less globose but much less so than in *uichancoi*; supra-orbitals and occipitals quite large, spinose, median and lateral coronals somewhat smaller than supra-orbitals and occipitals, more tuberculate, a smaller pair of tubercles laterad of lateral coronals; general surface with numerous small, scattered tubercles, a pair slightly meso-posterior of antennal bases slightly more prominent than the others; antennae much as in *uichancoi*.

Pronotum rectangulate, a little longer than wide, about half as long as mesonotum; posterior pronotals quite strongly spinose, anterior laterals

short, weakly defined, inter-posteriors small tuberculate, between posteriors a pair of still smaller tubercles, general surface with numerous scattered low tubercles; anterior coxae quite simple with a pair of spines on distal margin, external one much larger than internal, the latter quite small.

Mesothorax with mesonotum elongate, sub-rectangulate, approximately twice as long as wide; anterior mesonotals, medials at anterior third and laterals all large spinose; post-lateral somewhat smaller, pre-lateral relatively small; posteriors quite large and prominent and somewhat compound; general surface covered with scattered low tubercles. Mesopleura with laterals and supra-coxals spinose-tuberculate forming an irregular series, meso-pleural strong, general surface with low tubercles. Mesosternum with faint medio-longitudinal carina, mesosternal rows with tubercles stronger posteriorly.

Metathorax with mesonotum, excluding median segment, subquadrate, slightly more than half as long as mesonotum; posterior mesonotals rather strong, weakly compound, a pair of very small tuberculate anterior mesals, from posteriors a series of low tubercles running anteriorly and slightly mesad; lateral margins of mesonotum with a few low tubercles. Median segment broadly transverse, anteriors strongly spinose, meso-laterals and laterals smaller, tuberculate, medio-longitudinal carina present but rather weak. Metapleura with laterals and supra-coxals rather strong, forming a more or less continuous series, metapleural strong. Metasternum with marginal folds relatively deep and rather broad, a few tubercles in a row in a position similar to that of mesosternals, postero-lateral margin with a prominent spinose tubercle.

Abdomen with tergites strongly transverse, proximal abdomen tergites with latero-anteriors, medials, first and second paired posteriors all strong, spinose; medio-longitudinal carina faint, on this line near posterior margin on tergites 2 to 5 (including median segment in count) a tubercle or spine, sixth tergite with a trigonal lobe, seventh with a larger subrostrate lobe, eighth with a still larger subrostrate lobe; penultimate tergite with posterior margin more or less arcuate, but with a rather strong median emargination, this tergite lacks tubercles or spines, ultimate longer than penultimate, medio-longitudinal carina distinct, lateral margins rather strongly convergent to posterior margin which is subtruncate: proximal abdominal sternites with a medio-longitudinal carina.⁴⁹

All limbs essentially as in *uichancoi*; anterior femora about two and one-half times as long as pronotum; median femora slightly longer than mesonotum; posterior femora a little shorter than pro- and mesonotum.

General color dark fuscous to blackish, upper surface of thorax mottled with light yellowish green to yellowish, ventral side of mesothorax more or less slate colored, marginal folds of metasternum yellowish; coxae, femora and tibiae mottled with pale slate color and yellowish, tarsi blackish fuscous.

Length of body, 64 mm.; length of pronotum, 5; length of mesonotum, 10.8; length of metanotum, 6; length of median segment, 3.5; length of anterior femur, 12.5; length of median femur, 11.2; length of posterior femur, 14.

This interesting species is known only from the type.

⁴⁹ We are not describing the apex of the abdomen as the unique type of this species is immature.

BRASIDAS⁵⁰ new genus

Genotype (by present designation).—*Brasidas samarensis* new species.

This genus, which includes *Obrimus quadratipes* Bolivar, *O. foveolatus* Redtenbacher and several species here described, is quite distinct from the other genera in this complex as it has semi-cingulate fossae on the metasternum. Although the members of *Brasidas* superficially resemble some of the species of *Aretaon*, *Obrimus* and *Euobrimus*, they are immediately separable by the character of this area alone, as this genus has semi-cingulate metasternal fossae while *Obrimus* has a metasternal marginal fold, *Euobrimus* has completely cingulate fossae and *Aretaon* lacks any metasternal specialization.

Generic characters.—Medium to large sized forms; female quite heavy, spinose to spinoso-tuberculate, with low tubercles scattered over the surface; males much more slender and elongate, with prominent spines, often with general surface more or less smooth or weakly granular, sometimes with low scattered tubercles. Head, in both sexes, with both lateral and median coronals, supra-orbitals and occipitals, these spines or spinose tubercles relatively prominent, often other smaller tubercles, such as gulars, present. Pronotum somewhat longer than broad, the only prominent spines being posteriors, which, in general are quite strong and simple but in *acanthoderus* are decidedly compound. Mesonotum, in the female sex, quite heavy, posteriors quite strong, varying from simple to compound, anterior mesonotals present, varying from practically sub-obsolete to rather prominent, with either median or post-median mesonotals or both, these simple spinose tubercles, a series of laterals, medio-lateral always present and larger than laterals; mesonotum of male elongate, rather slender, posterior mesonotals very prominent, varying from simple strong spinose tubercles (*samarensis*) through bifid spines (*asper*) to compound crest-like processes (*montivagus* and *quadratipes*), the more usual type being that found in *samarensis*, anterior mesonotals present, usually rather large but at times sub-obsolete, pre-medials and medials may not be present. Metanotum of females quite heavy and tuberculate, posteriors always present, varying from simple to compound, other major spines usually not present, except in *quadratipes* which has the anterior mesals present, median segment with medials at least faintly indicated; metanotum of males more slender, general surface usually more or less smooth, rarely with low scattered tubercles, posteriors quite strong, ranging from simple to a crest-like process, median segment smooth or with low tubercles, lacking medials. Meso- and metasterna with mesosternals tuberculate, usually relatively small in the females, sub-obsolete or but slightly larger than scattered tubercles in the males, metasternum with large lateral semi-cingulate fossae, these often appearing as long open pits, the cingulation complete on external margin, either lacking or incomplete on anterior portion of internal margin, always lacking on posterior portion of internal margin. Abdominal tergites ranging from smooth, through a stage with scattered tubercles, to an extreme development with a definite and complicated spine arrangement. Femora rather

⁵⁰ Βρασιδάς — *Brasidas*, a Spartan general in the Peloponnesian War.

heavy, the four marginal carinae (dorso-anterior and posterior and ventro-anterior and posterior) usually with spaced serrations, sometimes lacking on dorso-anterior carina, at times reduced on both dorsal carinae; anterior femora with basal flexure quite weak, margins adjacent often bare; tibiae as in other genera of this complex, ventral margins with serrations, dorsal margin denticulate to practically smooth.

Key to Species and Subspecies

1. Males 2
Females 7
2. Proximal abdominal tergites unarmed 3
Proximal abdominal tergites armed with paired spines 4
3. Posterior meso- and metanotal spines simple; mesonotum without medio-lateral spines; general surface smooth ..*samarensis* new species
Posterior meso- and metanotal spines compound; mesonotum with rudiments of medio-lateral spines; general surface rugose.
quadratipes (I. Bolívar)
4. Meso- and metanotal posterior spines somewhat compound; mesonotal median and medio-lateral spines relatively strong; general surface somewhat rugose*montivagus* new species
Meso- and metanotal posterior spines simple; mesonotal medio-laterals either spinose or rudimentary tubercles; medians, if present, only rudimentary tubercles; general surface relatively smooth to granulose 5
5. Mesonotal laterals strong, spinose; anteriors twice as large as antero-laterals of mesopleura*viscayanus* new species
Mesonotal laterals tuberculate; anterior and antero-laterals of mesopleura subequal 6
6. Mesonotum without medials; pronotum with antero-laterals tuberculate*foveolatus foveolatus* (Redtenbacher)
Mesonotum with medials tuberculate; pronotum with antero-laterals spinose*foveolatus asper* new subspecies
7. Posterior pronotals strongly compound; all spines very strong, general appearance very spinose*acanthoderus* new species
Posterior pronotals not compound; spines not strong, general appearance rugoso-spinose 8
8. Mesonotal medials and post-medials present 9
Mesonotal medials present but lacking post-medials 10
9. Posterior meso- and metanotals strongly compound; anterior medials of metanotum distinct; proximal abdominal tergites with anteriors, medials, and a full posterior series*quadratipes* (I. Bolívar)
Posterior meso- and metanotals not strongly compound; metanotum lacking anterior medials; proximal abdominal tergites with anteriors, lacking evident medials and a posterior series.
samarensis new species
10. Proximal abdominal tergites with anteriors, medials and a full posterior series; abdominal tergites 5 or 6 to 9 with a medio-posterior elevated specialization which is progressively larger posteriorly.
montivagus new species

Proximal abdominal tergites with anteriors, lacking medials and a posterior series; abdominal tergites 6 to 9 with a medio-posterior elevated specialization which is smallest on the seventh tergite.

viscayanus new species

The female sex of *foveolatus foveolatus* and *f. asper* and the male sex of *acanthoderus* are unknown.

Brasidas samarensis new species

Plate 35, fig. 33; pl. 36, fig. 37.

The male sex of *samarensis* differs from that sex of all the other known members of the genus except *quadratipes*, by lacking definite spines on any of the abdominal tergites; from that sex of *quadratipes* the present form may be distinguished by having the posterior meso- and metanotal spines simple, the general surface of the body smooth and by lacking medio-lateral mesonotal spines, while the semi-cingulate fossae of the metasternum are rather narrow, resembling a large open pit.

The female sex has the following combination of characters which separates it from any of the other known forms; the posterior pronotals are simple, the posterior meso- and metanotals are weakly compound, the mesonotum has medials and post-medials but lacks pre-medials; the present form resembles the female sex of *quadratipes*, but differs from it by lacking anterior medials on the metanotum and the absence on the proximal abdominal tergite of medials and a full posterior series.

Type.—♂; Samar, Philippines. (Baker.) [United States National Museum.]

General size relatively large for the genus; general form rather slender and quite elongate; surface, except for elements of armament, relatively smooth to slightly granulose.

Head a little broader than long, anterior margin, as seen from the dorsum, arcuate, lateral margins slightly arcuate; eyes quite large, globose, very prominent; antennae with two basal articles relatively heavy, basal article more than twice as long as second, remaining articles slender, rectangular; head with supra-orbitals, occipitals and both lateral and median coronals rather strong, supra-antennals small, remainder of head with low scattered granules.

Pronotum rectangular, slightly longer than broad; with large prominent posteriors, antero-laterals represented by low tubercles; on antero-lateral portions of disk a rather deep subtrigonal pit; transverse sulcus behind the middle, convex posteriorly.

Mesonotum elongate infundibuliform, two and one-half times as long as pronotum; anteriors represented by low tubercles, posteriors large, strong, spinose, general surface with low scattered granules. Mesopleura with mesopleural relatively strong, spinose; a small tubercle on postero-lateral angle of mesopleura. Mesosternum with a few scattered granules, and showing a slight tendency toward a postero-sternal.

Metanotum, with median segment, elongate rectangular, metanotum, without median segment, slightly less than half as long as mesonotum;

posteriors large, strong, spinose, general surface with small scattered granules. Metapleura with metapleural relatively strong, a short supra-coxal series. Median segment about as long as broad, relatively smooth. Metanotum with semi-cingulate fossae rather large and quite narrow, appearing like elongate slits.

Abdominal tergites smooth with basal one sub-trapeziform, narrowest at posterior margin, others elongate rectangulate, from slightly less than twice to twice as long as broad; towards apex a tendency toward a medio-longitudinal carina. Ultimate tergite subquadrate, lateral margins slightly arcuate and convergent posteriorly, posterior margin weakly excised mesad. Poculum cap-shaped with a definite medio-longitudinal carina on posterior third, dorso-lateral margins weakly arcuate.

Anterior limbs relatively slender; femora a little longer than mesonotum, basal flexure weak but discernible on both anterior and posterior surfaces, all margins carinate, occasionally low spinules on these carinae. Tibiae slightly shorter than femora, margins carinate, armed with numerous short bristles. Tarsi with metatarsus longer than succeeding three articles, second article less than half as long as metatarsus, third article less than a third as long as metatarsus, terminal article slightly shorter than metatarsus, claws strong, heavy, curved, arolium and pulvilli present.

Median femora relatively slender, slightly shorter than mesonotum, all margins weakly carinate, ventral ones, particularly in apical half, with a few strong but spaced serrations. Tibiae and tarsi as on anterior limb except that metatarsus is proportionately shorter.

Posterior femora relatively slender, as long as pro- and mesonotum together, margins weakly carinate, dorsal ones with low, spaced tubercles; ventral ones, particularly in apical half, with spaced serrations. Tibiae and tarsi as in median limbs.

General color fuscous with a slight tendency for a green medio-longitudinal stripe; venter lighter fuscous; limbs fuscous, tarsi varying from fuscous to black.

Length of body, 62 mm.; length of pronotum, 4; length of mesonotum, 13.3; length of metanotum, 6; length of median segment, 3.5; length of anterior femur, 15; length of median femur, 13; length of posterior femur, 17.2.

Allotype. — ♀; Same data as type. [United States National Museum.]

General form rather large and quite robust for the genus, surface with many spines and a general covering of granules.

Head subrectangulate slightly longer than broad; supra-orbitals, occipitals, median and lateral coronals rather strong, supra-antennals rather small, gulars scarcely evident, general surface with scattered granules; eyes relatively large, globose but not as prominent as in male.

Pronotum subrectangulate, a little longer than broad; posteriors strongly spinose, remainder as in the male.

Mesonotum subconical, about twice as long as pronotum; anteriors, medials, post-medials, and median laterals present and relatively strong, posteriors weakly compound, the posteriors being large and spinose but with smaller tubercles around the base; general surface with numerous granules. Mesopleura with large strong mesopleural, antero-lateral meso-

pleural tuberculate, lateral margin of pleura with scattered spines, the medio-lateral being largest. Mesosternum with mesosternals low, tuberculate.

Metanotum with median segment two-thirds as long as mesonotum; posteriors weakly compound, the posterior itself quite large and the base surrounded by numerous smaller tubercles; general surface granulose. Metapleura with metapleural large, antero-lateral, laterals, medio-lateral and supra-coxals all relatively strong. Metasternum with a short row of metasternals; semi-cingulate fossae quite broad, resembling large open, almost semi-circular pits. Median segment with medials rather large, tuberculate, remainder of sclerite granulose.

Abdominal tergites broadly transverse, about twice as broad as long; a distinct medio-longitudinal carina present throughout the abdomen; antero-laterals tuberculate, remainder of tergites with numerous granules. Penultimate tergite with lateral margins arcuately convergent posteriorly, posterior margin less than one-sixth as long as anterior one, the former weakly and evenly concave. Ultimate tergite infundibuliform, broadest proximad, carinate in basal two-thirds, apex rounded. Operculum greatly elongate, navicular, in distal half carinate, apex rounded, acute-angulate, surpassing ultimate tergite.

Anterior femora a little longer than mesonotum, basal flexure scarcely evident, all margins carinate and serrate, more strongly so in apical half. Tibiae slightly shorter than femora, margins carinate. Tarsi as in male.

Median femora about as long as the mesonotum, all margins carinate and serrate. Tibiae shorter than femora, tarsi as in type male.

Posterior femora as long as pro- and mesonotum, remainder as in median limbs.

General color dark fuscous with areas of light fuscous scattered over the body; limbs dark fuscous with tarsi varying from dark fuscous to black.

Length of body, 92 mm.; length of pronotum, 7.5; length of mesonotum, 17; length of metanotum, 8.2; length of median segment, 4.8; length of anterior femur, 19; length of median femur, 16.5; length of posterior femur, 24; length of ultimate tergite, 7.5; length of operculum, 20.5.

Paratypes. In addition to the type and allotype, we have examined another pair, with the same data, which agrees in all essential features with them, and we are considering these paratypes.

Besides the paratypes we have three immature females that we are referring to this species. These have the same data as the type and agree with the allotype in all except the following respects: the basal abdominal tergites have medials and a full posterior series present as well as the anteriors. Although in these features they seem to agree with *quadratipes* we believe that they represent the immature form of the present species. Moreover, *quadratipes* is not at present known from the island of Samar.

Specimens examined. — 7; 2 ♂, 2 ♀, 3 juv. ♀.

SAMAR: (Baker); 2 ♂, 2 ♀, 3 juv. ♀, (type, allotype, paratype); [U.S.N.M.].

Brasidas quadratipes (I. Bolívar)

Plate 33, fig. 23; pl. 38, fig. 43.

1890. *Obrimus quadratipes* I. Bolívar, Anal. Soc. Españ. Hist. Nat., XIX, p. 307. [♂; "Filipinas".]1895. *Obrimus quadratipes* Elera, Fauna Filipinas, II, p. 208.1904. *O[brimus] quadratipes* Kirby, Syn. Cat. Orth., I, p. 398.1906. *Obrimus quadratipes* Redtenbacher, Insektenfam. Phasm., I, pp. 39, 40.1915. *Obrimus quadratipes* Bruner, Univ. Nebr. Stud., XV, no. 2, p. 229.

The male of this species is rather closely related to *samarensis*, and these two forms differ from the other known members of this genus by lacking paired spines on the abdominal tergites, but may be separated from *samarensis* by having the posterior meso- and metanotal spines compound, the medio-laterals of the mesonotum rudimentary and the general body surface rugose, while in *samarensis* the posteriors are simple, the medio-laterals are absent and the general surface is smooth. The females of the present form have much in common with those of *samarensis* but do show some appreciable difference. The following combination of characteristics will serve to distinguish this from any of the known forms; posterior meso- and metanotal spines strongly compound, much as in *montivagus*, posterior pronotals simple, mesonotum with medials and post-medials distinct and spinose as in *samarensis* and *montivagus*, metanotum with anterior medials very prominent, a feature peculiar to the present form, the proximal abdominal tergites with anteriors, medials and a full posterior series.

As the only material of this form before us is quite immature, we feel that it is not advisable to give a detailed description of this little-known species, leaving this for some future worker who has adult material.

Specimens examined.—8; 4 juv. ♂, 4 juv. ♀.

SIARGAO: 2 juv. ♂, 1 juv. ♀; [Hebard Cln.].

MINDANAO: Surigao; 1 juv. ♂; [Hebard Cln.]; 2 juv. ♀; [U.S.N.M.].
Davao; 1 juv. ♂; [Hebard Cln.]. Bucos; 1 juv. ♀; [Hebard Cln.].

Brasidas foveolatus foveolatus (Redtenbacher)

Plate 34, fig. 25.

1906. *Obrimus foveolatus* Redtenbacher, Insektenfam. Phasm. I, pp. 39, 40. [♂; Mindanao.]1915. *Obrimus foveolatus* Bruner, Univ. Nebr. Stud. XV, no. 2, p. 229.

The male of this, the typical form of the species, while being most closely related to the subspecies *foveolatus asper* is also related to *viscayanus* and *montivagus*, as in all of these forms the proximal abdominal tergites are armed with paired spines or spinose tubercles; from these other species the present form differs by having the mesonotal medio-laterals represented by subobsolete tubercles and not by definite spines, moreover, the posterior meso- and metanotals are simple, the mesonotum is without medials and the anteriors and antero-laterals of the pleura are subequal in length, the limbs are rather long, the anterior femora being as long or longer than the pro- and mesonotum.

The female sex of this form is not known. The original description is so incomplete that an exhaustive study of a large amount of material was necessary to determine which of several related forms were before Redtenbacher.

We feel that the study of this group by future workers may be aided by the following detailed description.

Male. General form relatively small and slender, surface with many small granules but these are not particularly prominent.

Head subrectangulate, a little longer than broad; eyes subglobose, relatively large and rather prominent; medians and lateral coronals, occipitals and supra-orbitals relatively strong, supra-antennals subobsolete tubercles; two basal antennal articles relatively heavy, remainder slender, rectangulate, individually longer apically.

Pronotum subrectangulate, somewhat longer than broad; posteriors strong, simple spines; pits on antero-lateral portion of disk relatively large but not deeply impressed, transverse sulcus shallow behind middle, convex posteriorly; antero-lateral angles tuberculate.

Mesonotum elongate, subcylindrical, a little more than twice as long as pronotum; anteriors spinose, posteriors simple with a large element and rudiments of posterior crests; medio-laterals subobsolete tubercles; general surface granulose. Mesopleura with large simple mesopleural; antero-lateral subequal to anterior pronotals, laterals and supra-coxals represented by weak tubercles. Mesosternum with mesosternals small, tuberculate; a faint indication of a medio-longitudinal carina, a low swelling intercoxally.

Metanotum with median segment sub-rectangulate, two-thirds as long as mesonotum; posterior metanotals much as posterior mesonotals, general surface granulose. Metapleura with large, simple metapleural, supra-coxals relatively strong, laterals subobsolete, surface granulose. Median segment granulose. Metasternum with metasternals subobsolete tubercles, a low intercoxal swelling; semi-cingulate fossae asymmetrically tear-shaped, deep open pits.

Basal abdominal tergites with paired anterior spines, these being on from the second and third to the second to fifth, including median segment in count; all tergites subquadrate to slightly transverse, granulose. Ultimate tergite slightly narrowed posteriorly, posterior margin concave with a decided median excision. Poculum relatively large, cup-shaped, distal third with a medio-longitudinal carina, dorso-lateral margins arcuate, a medio-posterior excision.

Anterior femora relatively long and rather slender, almost as long as pro- and mesonotum; margins carinate. Median femora slightly longer than mesonotum. Posterior femora a little longer than pro- and mesonotum; all limbs essentially as in *samarensis*.

General color light fuscous with various portions dark fuscous, venter light ochre to light fuscous, some spines and tarsi black.

There is little variation in size as shown by the following measurements which represent the extremes of the individuals before us: length of body, 54-58 mm.; length of pronotum, 4.5-5; length of mesonotum, 11-11.2; length of metanotum, 5-5.1; length of median segment, 3-3.2; length of anterior femur, 14.2-14.6; length of median femur, 13-13.5; length of posterior femur, 17-17.2.

There is no appreciable difference in the specimens before us except as noted above.

Specimens examined. — 3; 3 ♂.

MINDANAO: Tanglecolan, Bukidnon; (Baker); 1 ♂; [Hebard Chn.]: 2 ♂; [U.S.N.M.].

Brasidas foveolatus asper new subspecies

Plate 34, fig. 26.

This subspecies is closely related to the typical form but may be separated from it by having the mesonotal medials tuberculate instead of lacking, while the antero-laterals of the pronotum are small but distinctly spinose instead of being tuberculate. Moreover, all the limbs are shorter and proportionately heavier, the anterior femora being considerably shorter than the length of the pro- and mesonotum, while in the typical form these femora are almost as long as the pro- and mesonotum.

The female of this subspecies is unknown.

Type. — ♂; Davao, Mindanao, Philippines. (Baker.) [United States National Museum.]

General form shorter than but practically as stout as the typical form, general surface with small granules as in the nominate form.

Head as in the typical form, but supra-orbitals, occipitals, median and lateral coronals smaller, low tuberculate, only slightly more prominent than supra-antennals.

Pronotum as in nominate form except that antero-laterals are small and distinctly spinose.

Mesonotum slightly shorter and heavier than in the typical form, armament essentially as in the latter, except that the medials are distinctly present and distinctly tuberculate, medio-laterals practically obsolete. Mesopleura with antero-lateral more distinctly spinose. Mesosternum with medio-longitudinal carina more prominent, postero-sternal swelling larger.

Metanotum essentially as in typical form. Metapleura with metapleural represented by a low tubercle, laterals smaller. Metasternum as in typical form.

Abdominal tergites as in *f. foveolatus* but with paired spines only on tergites 2 to 4. Ultimate sternite and poculum as in typical form.

Anterior femora relatively heavy, only a little longer than mesonotum; median femora heavy and only as long as mesonotum; posterior femora heavy, as long as pro- and mesonotum; limbs otherwise except for length and stature as in the typical form.

General color fuscous, varying to lighter fuscous, particularly along mid-dorsal line, venter light fuscous; limbs relatively dark with portions of tarsi and claws practically black.

Length of body, 50 mm.; length of pronotum, 5; length of mesonotum, 10.5; length of metanotum, 5; length of median segment, 3; length of anterior femur, 12.2; length of median femur, 10.5; length of posterior femur, 15.5.

This form is known only from the type.

Brasidas viscayanus new species⁵¹ Plate 31, fig. 12; pl. 34, fig. 27; pl. 38, fig. 45.

The female of *viscayanus* can best be compared with that of *montivagus* with which it agrees in having the posterior pronotals simple, the posterior meso- and metanotals somewhat compound, the mesonotal anteriors and medials present, although the latter are not as strong in *viscayanus* as they are in the related forms, being approximately half as long as the laterals.

The male of this species is quite distinctive but is in all probability most closely related to the *foveolatus* complex. The following combination of characteristics will serve to distinguish the male sex from that of the other known members of the genus; posterior pro-, meso- and metanotals simple, proximal abdominal tergites with paired anteriors, thus agreeing to this extent with *foveolatus* but differing from it by having the lateral mesonotals strongly spinose, anteriors of mesonotum twice as long as antero-laterals instead of the laterals being tuberculate and the anteriors and antero-laterals subequal; moreover, in the present form the body is more elongate, the mesonotum is proportionately longer, and the femora have the dorsal carinae only faintly indicated.

From *montivagus* the present form is separated by having on the proximal abdominal tergites only the paired anteriors and a pair of tubercles near the pleural margin slightly behind the middle of the tergite, and by lacking medials; except on the median segment a full posterior series is present, moreover, the elevated medio-posterior specialization on the abdomen is on tergites 6 to 9, but that on the seventh is quite small, instead of being progressively larger on tergites 5 or 6 to 9.

It is our belief that the female of this form will resemble, even more closely than the males, the, as yet unknown, female of *foveolatus*.

Type. — ♀; Butuan, Mindanao, Philippines. (Baker.) [Hebard Collection, Type no. 1299.]

General size relatively large, rather stout; elements of armature quite prominent, general surface quite granulose.

Head longer than broad, subrectangulate; supra-orbitals, occipitals, median and lateral coronals rather large, tuberculate, rather prominent, supra-antennals subobsolete tuberculate, median occipitals a row of low subobsolete tubercles; general surface with scattered, relatively large tubercles; eyes rather large, subglobose, rather prominent; antennae with two basal articles relatively thick, remaining articles elongate, rectangulate, gradually becoming shorter apically.

Pronotum somewhat longer than broad, subrectangulate; posteriors rather strong, tuberculate and with one or two supplementary tubercles, antero-laterals relatively prominent spinose tubercles, between posteriors several small tubercles arranged in two longitudinal rows; general surface with scattered granules; pits on antero-lateral portion of disk rather deep, subtrigonal.

⁵¹ Named after the Viscayans, one of the several groups of natives which are inhabitants of Mindanao.

Mesonotum elongate, almost twice as long as broad; anteriors, medials, and posteriors rather large, tuberculate, the latter with supplementary tubercles making the whole appear suberistate, medials slightly staggered, the medio-laterals strong, spinose tubercles, general surface with numerous scattered granules. Mesopleura with a rather large spinose mesopleural, antero-lateral rather large, lateral margin of pleura with a few large scattered tubercles and several smaller ones, postero-lateral angle spinose. Mesosternum quite smooth except for the mesosternals which are rather prominent, but low and tuberculate.

Metanotum rather elongate, its length, excluding median segment, equal to half that of mesonotum; posteriors quite strong with numerous supplementary thus appearing suberistate, general surface with scattered granules. Metapleura with a large spinose metapleural; laterals and supra-coxals relatively large spinose tubercles, general surface granulose. Median segment with medials tuberculate, general surface granulose. Metasternum with metasternals small, tuberculate; semi-cingulate fossae large open asymmetrically tear-shaped pits.

Abdominal tergites individually broadly transverse, tergites 2 to 5 (including median segment in count) with large, spinose anteriors, these represented by low tubercles on remaining tergites, surface with a few granules; tergites 6 to 9 with a medio-posterior specialization, those on sixth and seventh node-like, the latter smaller, eighth larger and broader, much like that on ninth which is subrostrate. Penultimate tergite about as long as broad, lateral margins slightly arcuate, convergent posteriorly, lateral portions of posterior margin obliquely truncate, median portion emarginate. Ultimate tergite elongate, tectate, lateral margins weakly emarginate. Opereulum elongate, slightly surpassing ultimate tergite, lanceolate, carinate in apical four-fifths, apex recurved, acute-angulate, narrowly rounded.

Anterior femora relatively short and stout, slightly longer than mesonotum; basal flexure evident on anterior margin, faintly so on posterior; all margins carinate; dorsal margins serrate throughout, anterior more strongly so; ventral margins serrate in apical half, more strongly so on anterior margin. Tibiae almost as long as femora, all margins carinate. Tarsi with metatarsus about as long as succeeding three articles, ultimate long, heavy; claws strong, curved; pulvilli and arolium present.

Median femora relatively short and stout, about as long as mesonotum; all margins carinate, all margins serrate, dorsal ones more strongly so. Tibiae and tarsi as in anterior limbs except that metatarsus is shorter.

Posterior femora rather long and stout, about as long as pro- and mesonotum. Limbs otherwise essentially as median ones.

General color dark fuscous to black, thoracic armature usually light fuscous, venter light fuscous.

Length of body, 90 mm.; length of pronotum, 6.5; length of mesonotum, 15; length of metanotum, 7; length of median segment, 5; length of anterior femur, 16.5; length of median femur, 15; length of posterior femur, 21.5; length of ultimate tergite, 6.5; length of opereulum, 21.5.

Allotype. — ♂; Same data as type. [United States National Museum.]

Size relatively large and rather smooth for the genus, major elements of armature quite prominent.

Head rectangulate, a little longer than broad; supra-orbitals, occipitals, median and lateral coronals relatively strong tubercles, supra-antennals low, subobsolete tubercles, general surface with scattered granules; eyes rather large globose.

Pronotum elongate rectangular; posteriors quite prominent, spinose; pits on antero-lateral portion of disk transverse elliptical; antero-lateral angles with a small tubercle.

Mesonotum elongate; anteriors and posteriors strong, spinose, anteriors much larger than antero-laterals of mesopleura; medio-laterals of notum strong, spinose, surface with scattered granules. Mesopleura with a strong, spinose mesopleural, antero-lateral relatively small, tuberculate, surface granulose. Mesosternum with mesosternals weak, tuberculate, surface with granules.

Metanotum with strong posteriors, a few scattered granules. Metapleura with metapleural strong, spinose; supra-coxals relatively strong, laterals represented by subobsolete small tubercles; semi-cingulate fossae, tear-shaped pits.

Abdominal tergites basally subquadrate, distally rectangulate; tergites 2 and 3 (including median segment in count) with spinose anteriors, general surface relatively smooth; eighth and ninth tergites with a distinct medio-longitudinal carina. Ultimate tergite with lateral margins gradually convergent posteriorly, posterior margin deeply excised mesad. Poculum, in lateral view, more or less subrectangulate; dorso-lateral margins labiate, cleft posteriorly.

Anterior femora relatively elongate, a little shorter than pro- and mesonotum; basal flexure present on anterior and barely evident on posterior margins; margins not distinctly carinate, a few serrations on anterior margins in apical half. Tibiae about as long as femora, margins weakly carinate, anterior tarsi as in female.

Median femora relatively long, and rather stout, as long as mesonotum; margins weakly carinate, a few low serrations on ventral margins, dorsal margins with scattered subobsolete serrations. Tibiae a little shorter than femora, margins carinate. Tarsi as in female sex.

Posterior femora rather long and relatively stout, almost as long as meso- and metanotum; remainder of limb essentially as median limb but metatarsus a little longer.

General color fuscous, anterior and posterior limbs lighter, venter of abdomen light fuscous.

Length of body, 62 mm.; length of pronotum, 4; length of mesonotum, 14; length of metanotum, 5.5; length of median segment, 3.5; length of anterior femur, 16; length of median femur, 14; length of posterior femur, 18.8.

The type and allotype of this species, both from Butuan, Mindanao, are all that are known of this interesting form.

Brasidas montivagus new species

Plate 33, figs. 19, 20.

The male of the present species resembles, to some extent, that of *quadratipes* in the spination of the thorax having the posterior meso- and metanotals compound and the posterior pronotals and the anterior meso-

notals simple, but differs from it by having the median and lateral mesonotals well developed; moreover, *montivagus* differs from both *quadratipes* and *samarensis*, and agrees with the other members of the genus, by having spines on the proximal abdominal tergites. However, these other forms do not have the thorax spination as noted above. The female of *montivagus* has in general the thoracic spination found in *viscayanus* but differs from that by the following features of abdominal spination; the proximal tergites with anteriors, medials and a full posterior series instead of lacking the latter two, and there is a medio-posterior elevated specialized area on the sixth to ninth tergites, which in related forms, if there is an elevated specialized area, is on the eighth to ninth tergites.

Type.—Juv. ♂; Mt. Galintan, Davao, Mindanao, Philippines. May, 1927. (R. C. McGregor.) [United States National Museum.]

General form rather short and stout; surface more or less granulose, with major elements of armature relatively prominent.

Head slightly longer than broad, subrectangulate; supra-orbitals, occipitals, median and lateral coronals rather prominent, spinose, area bounded by occipitals and median coronals slightly elevated, resembling a symmetrical trapezoid; supra-antennals barely discernible, low, subobsolete tubercles; general surface granulose; eyes relatively prominent, subglobose; antennae with two basal articles heavy (remainder broken).

Pronotum longer than broad, subrectangulate; posteriors prominent, erect, latero-anteriors small tuberculate; transverse sulcus not prominent, just before posteriors, convex posteriorly; pits on latero-anterior portion of disk relatively shallow, subtrigonal; general surface with scattered relatively large granules.

Mesonotum elongate rectangulate, a little more than twice as long as pronotum; anteriors, medials and medio-laterals relatively strong, spinose, posteriors rather strong, arising from a suberistate base; general surface granulose. Mesopleura with mesopleural a rather prominent spinose tubercle,⁵² antero-lateral a rather prominent tubercle, supra-coxals irregular, tuberculate, laterals represented by subobsolete tubercles. Mesosternum with medio-longitudinal carina indicated, mesosternals tuberculate, lateral portions granulose, median portion relatively smooth.

Metanotum with posteriors rather strong, arising from suberistate base; general surface granulose. Metapleura with metapleural relatively large, spinose, supra-coxals and laterals relatively large, tuberculate. Median segment granulose, anteriors, medials and a full posterior series represented by subobsolete tubercles. Metasternum with metasternals low tuberculate, more prominent anteriorly; semi-cingulate fossae quite broad and rather shallow, guttate.

Abdominal tergites subquadrate basally, gradually becoming transverse apically; tergites 2 and 3, including median segment in count, with relatively strong anteriors, these discernible on remaining tergites as low, subobsolete tubercles, medials and a full posterior series present but rudimentary on

⁵² One of the mesopleurals is quite evidently deformed and is represented by a small, practically subobsolete tubercle.

these tergites, the posterior mesal being node-like on the sixth and seventh tergites, a snout-like production on the eighth and a substrate one on the ninth.

We are not giving a detailed description of the apex of the abdomen as the type is immature, but the following characters may be of some value: lateral margins of apical tergites subfoliaceous, ultimate tergite with posterior margin incised, poculum cup-shaped.

Anterior femora relatively short and stocky, a little longer than mesonotum; basal flexure rather prominent on anterior and discernible on posterior margins; all margins carinate and with low serrulations, those on distal half of dorso-anterior margin much larger. Tibiae a little shorter than femora, all margins carinate. Tarsi with metatarsus about as long as the succeeding articles, ultimate longer than metatarsus, claws strong, curved; pulvilli and arolium present.

Median femora short and rather heavy, as long as mesonotum; margins carinate and dorso-anterior margin with serrations. Tibiae a little shorter than femora, all margins carinate, extensor with minute serrulations, flexor with serrulations. Tarsi much as anterior tarsi, except that metatarsus is shorter.

Posterior femora relatively short and stout, a little shorter than meso- and metanotum, remainder as in median femora. Tibiae and tarsi much as in median limb but metatarsus longer.

General color snuff brown varying to tawny-olive, with a slight suffusion of mineral green; venter pale fuscous; femora and tibiae mineral green, tarsi fuscous, claws black.

Length of body, 50 mm.; length of pronotum, 43; length of mesonotum, 9.5; length of metanotum, 5; length of median segment, 3; length of anterior femur, 10.3; length of median femur, 9.5; length of posterior femur, 12.

Allotype.—Juv. ♀; Mati, Davao, Mindanao. April, 1927. (R. C. McGregor.) [United States National Museum.]

General form quite short and stocky; major elements of armature strong, spinose, general surface quite granulose.

Head essentially as in type, but area bounded by occipitals and median coronals not elevated.

Pronotum with posteriors large, spinose, antero-laterals small, tuberculate, anteriors low, tuberculate, remainder as in male.

Mesonotum with anteriors, medials and medio-laterals large spinose, posteriors large, arising from suberistate base, inter-posteriors low, sub-obsolete tubercles, pre- and post-medials low tuberculate, laterals as a whole small, tuberculate, general surface quite granular. Mesopleura with a large, spinose mesopleural, antero-lateral rather strong, tuberculate, laterals irregular, tuberculate, one rather large, tuberculate supra-coxal. Mesosternum with a faint indication of a medio-longitudinal carina; mesosternals rather large, tuberculate, rows divergent to posterior third, then slightly convergent.

Metanotum with posteriors large spinose, arising from a suberistate base, inter-posteriors low, tuberculate, antero-laterals small tuberculate, just before the base of the posterior crests, a pair of low tubercles on posterior margin between the posteriors; general surface quite granular. Metapleura

with a large spinose metapleural, laterals and supra-coxals rather large and spinose, general surface granular. Median segment with medials rather strong, tuberculate, full posterior series present but rather small, general surface granular. Metasternum with metasternals present anteriorly, tuberculate; semi-cingulate fossae ovoid, quite deep.

Abdominal tergites transverse; 2 to 5, including median segment in count, with anteriors strong spinose, medials smaller, tuberculate, and a full posterior series; the posterior mesal on tergites 6 to 9 progressively developing into a node, trigonal lobe, and finally into a sub-rostrate production; the apical tergites have the essential elements of armature represented only by subobsolete tubercles.

As the specimen is immature we are not describing the apex of the abdomen.

Anterior femora relatively short and rather heavy, twice as long as pronotum; basal flexure evident on anterior and discernible on posterior margins; all margins carinate and serrulate, serrulations in apical half of dorso-anterior margin strong. Tibiae and tarsi as in type male.

Median femora short and heavy, as long as mesonotum, limb as a whole resembling that of type.

Posterior femora shorter than pro- and mesonotum, limb essentially as in type.

General color bistre to snuff brown, venter light fuscous. Limbs bistre.

Length of body, 51.3 mm.; length of pronotum, 5; length of mesonotum, 9; length of metanotum, 5.5; length of median segment, 3; length of anterior femur, 10; length of median femur, 9; length of posterior femur, 11.5.

The pair of this species, from Davao Province, Mindanao, is unique.

Brasidas acanthoderus⁵³ new species

Plate 33, fig. 24.

This very distinctive form is known only from the female sex and may immediately be distinguished from the other members of the genus by having the posterior pronotals compound, tri-spinose, and the supra-coxals bifid. To some extent *acanthoderus* resembles *montivagus* and *viscayanus* by having the anterior, median and lateral mesonotals present and the posterior meso- and metanotals compound, but in this form all of these are more strongly developed than in any other member of this complex. Also *acanthoderus* agrees with *montivagus* in the spination of the proximal abdominal tergites, there being anteriors, medials and a full posterior series. However, the general very spiny appearance, as well as the great strength of all the major elements of the spination, is very distinctive of this form.

Type.—Juv. ♀; Davao,⁵⁴ Mindanao, Philippines. September, 1917. (C. M. W.) [Museum of Comparative Zoölogy.]

Size relatively small, body with numerous large spines and many smaller spinose tubercles.

⁵³ From *ἀκανθα*, thorn, and *δέπος*, hide, in allusion to the spiny covering.

⁵⁴ The specimen is labelled with a hand written label "Davas" and it seems probable that this was meant for either Davao Province or the city of Davao, the capital of the province.

Head longer than broad; lateral and median coronals strong, supra-orbitals strong, gulars and supra-orbital series weak, occipital medials reduced to one large posterior spine surrounded by several smaller spines.

Pronotum half as long as mesonotum, slightly longer than broad; anteriors, medials and laterals small, tuberculate, posterior pronotals large compound, inter-posteriors small.

Mesonotum twice as long as pronotum, one and one-half times as long as greatest width; a faint medio-longitudinal carina; spination strong, surface with numerous small, irregularly spaced, spinose tubercles, lateral margins sparsely tuberculate, with anteriors, medians and medio-laterals large, posteriors strongly compound. Mesopleura with a large compound mesopleural, large supra-coxal, antero-lateral and medio-lateral spines. Mesosternals present, of two sizes.

Metanotum slightly longer than pronotum, broader than long; with anterior mesals small, pre-inter- and inter-posterior metanotals small, surface sparsely spinose, posteriors strongly compound; metapleurals compound, four or five large supra-coxals, antero-lateral of pleura large; metasternals faint, metasternal foramina slightly removed from lateral margin, relatively large, sub-semicircular but not open pits. Median segment half as long as mesonotum; anteriors very small, medians very large, antero-laterals lacking, a full posterior series with the posterior mesal bifid, surface with scattered tubercles.

Abdominal tergites with antero-laterals very large, a full posterior series, general surface with scattered tubercles, third to fifth tergites with a pair of relatively large spines before the medials, beginning with the sixth tergite on there is a postero-mesal production, these becoming more specialized and larger on succeeding tergites, posteriorly becoming rostrate produced.⁵⁵

Anterior femora slightly longer than mesonotum; basal flexure marked on anterior but not prominent on posterior surface; all margins with spaced strong serrations. Anterior tibiae slightly shorter than femora. Anterior tarsi moderately elongate, proximal article longer than following two, second and third articles subequal, fourth very short, ultimate as long as first and second together, claws strongly curved, arolium large, half as long as tarsal claws, pulvilli present.

Median femora slightly shorter than mesonotum; entire limb much the same as anterior one except the proximal tarsal article is shorter, being as long as the following two articles.

Posterior femora slightly shorter than pro- and mesonotum, the remainder of limb the same as the anterior one.

General body color varying from tawny olive to fuscous, the larger spines of the meso- and metanotum are cinnamon buff, legs and antennae cinnamon buff annulated with light fuscous, ventral surface fuscous.

Length of body, 35.5 mm.; length of pronotum, 3; length of mesonotum, 7.5; length of metanotum, 4; length of median segment, 2.6; length of anterior femur, 7.8; length of median femur, 6.8; length of posterior femur, 9.3.

This species is known only from the unique type.

⁵⁵ A detailed description of the terminal portion of the abdomen is impossible as the specimen, aside from being immature, is greatly distorted.

EUOBRIMUS new genus

Genotype (by present designation). — *Euobrimus atherura* new species.

This new genus is erected for *Obrimus cavernosus* Stål and *O. lacerta* Redtenbacher, as well as for several new forms here described. While in general resembling the related genera *Brasidas* and *Obrimus* it is easily separable by the character of the metasternum, which in this genus has completely cingulate fossae, while in the other genera these are either semi-cingulate or are represented by marginal folds.

Generic characters. — Relatively small to large sized forms, females distinctly more robust than males; armature usually quite prominent, tuberculate to spinose, general surface smooth to distinctly granular, at times with low scattered tubercles. Head subquadrate, median and lateral coronals always present, developed to varying degrees, often with occipitals and supra-orbitals present, gulars often present. Pronotum longer than broad, subrectangulate; posteriors strong and simple except in *atherura* in which they are compound, surface smooth to granular. Mesonotum elongate, posteriors always evident, usually quite strong, simple or compound; anteriors usually present, simple, medials present or absent. Mesopleura with mesopleurals evident, often quite strong; usually with antero- and postero-lateral angles tuberculate or spinose; laterals and supra-coxals often well developed in females, usually absent in males. Mesosternum convex, with or without a medio-longitudinal carina, mesosternals present. Metanotum with posteriors usually strong, simple or compound; surface usually more or less granulose. Metapleura with metapleurals evident, usually strong, spinose, supra-coxals rather strong, laterals present or absent. Metasternum with metasternals often subobsolete; fossae completely cingulate, either large oval, or elliptical pits. Abdominal tergites either smooth or with definite armature the details of this varying with the various forms. Femora rather heavy, margins carinate, usually with serrations or serrulations; tibiae slightly shorter than femora, tarsi with anterior metatarsus longer than succeeding three articles, that of median tarsus about as long as the latter and that of posterior much like that of anterior limb.

Key to Species

1. Males 2
Females⁵⁶ 8
2. Proximal abdominal tergites with paired anterior spines 3
Abdominal tergites without definite spines 6
3. Posterior pro-, meso- and metanotals compound; lateral mesonotals present, relatively small, spinose*atherura* new species
Posterior pro-, and metanotals simple; lateral mesonotals present as subobsolete tubercles or absent 4
4. Occipitals present, tuberculate; medio-lateral mesonotal subobsolete; median mesonotals spinose tuberculate*hoplites* new species
Occipitals absent; lateral mesonotals absent and median mesonotals absent 5

⁵⁶ As discussed under *lacerta* we believe that Redtenbacher's association of that species is incorrect and we are limiting the form to the male described by him. As a result, the female of *lacerta* is not definitely known.

5. Mesopleura with antero-lateral; posterior mesonotals trispinose.
dohrni new species
 Mesopleura without antero-lateral; posterior mesonotals simple, spinose. *bakeri* new species
6. Metanotum with four large spines; anterior mesonotals present; abdomen smooth, carinate *lacerta* (Redtenbacher)
 Metanotum with posteriors only; anterior mesonotals absent, or if present the posterior metanotals are low tuberculate crests; abdomen smooth or granular, not carinate 7
7. Posterior pro-, meso- and metanotals large spinose tubercles; anterior mesonotals absent, general surface smooth *cavernosus* (Stål)
 Posterior meso- and metanotals low, tuberculate crests; anterior mesonotals tuberculate; general surface granulose *cleggi* new species
8. Posterior pronotals decidedly compound; anterior pronotals tuberculate *atherura* new species
 Posterior pronotals not decidedly compound; anterior pronotals absent or subobsolete tubercles 9
9. Post-medial mesonotals spinose; basal abdominal tergites with anteriors, medials, second paired posteriors and medio-laterals spinose.
cavernosus (Stål)
 Post-medial mesonotals absent; basal abdominal tergites with only anteriors quite evident or with four spines arranged in a trapezoid . 10
10. Posterior pro-, meso- and metanotals low suberistate ridges; medial mesonotals subobsolete; abdominal tergites with anteriors low, tuberculate *cleggi* new species
 Posterior pro-, meso- and metanotals, not low suberistate ridges, simple, spinose; medial mesonotals spinose; abdominal tergites with anteriors or four spines arranged in a trapezoid, spinose, not low, tuberculate 11
11. Mesonotum with twelve spines arranged in three transverse rows; abdominal tergites 2 to 6 with four spines arranged in a trapezoid; supra-anal plate with apex truncate *dohrni* new species
 Mesonotum with anteriors, medials and posteriors; abdominal tergites 2 and 3 with large, spinose anteriors; supra-anal plate with apex incised *bakeri* new species

The females of *hoplites* and *lacerta* are not known.

Euobrimus atherura ⁵⁷ new species

Plate 33, fig. 22; pl. 35, fig. 31.

This striking species which is not closely related to any of the other forms of the genus has some of the characters of *cavernosus* and some of those of *dohrni*, but may be distinguished in either sex, from all the other known members of the complex, by having the posterior pro-, meso- and metanotals all spinose and decidedly compound.

Type.—Juv. ♂; Baroring River, Mount Apo, Mindanao, Philippines. 7000 feet. November 8, 1930. (C. F. Clegg.) [Hebard Collection, Type no. 1298.]

⁵⁷ After the distinctive oriental hystrioid genus of rodents *Atherura*, in allusion to the spination.

General size relatively small for the genus, more or less flattened; quite rugose and major elements of armature quite prominent, many of these decidedly compound.

Head subrectangulate, a little longer than broad; eyes quite prominent, subglobose; supra-orbitals and occipitals large strong tubercles, subequal, median and lateral coronals tuberculate, relatively large, but smaller than occipitals, gulars represented by a row of subobsolete tubercles except the last which is quite prominent and relatively large; general surface with numerous low tubercles. Antennae with basal article flattened, longer than broad, second article barrel-shaped, remaining articles much longer than broad.

Pronotum subrectangulate, longer than broad, anterior margin concave; posteriors compound, tri- or bifid, transverse sulcus weak, immediately before posteriors; general surface with scattered low tubercles.

Mesonotum rectangulate, one and one-half times as long as broad; anteriors strong, spinose, medials subobsolete tubercles, posteriors more or less conical, compound, medio-lateral relatively large, tuberculate, general surface with numerous low tubercles. Mesopleura with antero-lateral tuberculate, one or two supra-coxal tubercles, mesopleural quite large, spinose, surface with scattered low tubercles. Mesosternum with a medio-longitudinal depression, postero-sternal low, node-like; mesosternals practically obsolete, tuberculate.

Metanotum rectangulate, longer than broad, slightly less than half as long as mesonotum; posteriors sub-conical, compound; surface with scattered low granules. Metapleura with laterals low, tuberculate, supra-coxals relatively large, spinose, surface with scattered low tubercles. Metasternum with large open, subcircular fossae, completely cingulate, but very feebly so. Median segment with low, scattered tubercles.

Abdominal tergites subquadrate to trapezoidal basally, broadly transverse apically; tergites 2 to 5 with anteriors strong spinose; tergites 2 to 7 with first and second paired posteriors subobsolete tuberculate, 4 to 9 with a medio-posterior specialized area increasing from a small node-like elevation anteriorly to a sublamellate area with an erect spiniform process distad posteriorly; general surface with small, scattered granules.⁵⁸

Anterior femora relatively elongate, a little longer than mesonotum; basal flexure quite evident on anterior and noticeable on posterior margins; anterior margins distad of flexure with spaced serrations, posterior margins with spaced serrations throughout. Tibiae a little shorter than femora, all margins carinate. Tarsi with metatarsus about as long as three succeeding articles, ultimate article longer than metatarsus, claws stout, curved, arolium and pulvilli present.

Median femora relatively heavy, about as long as mesonotum; all margins with spaced serrations. Tibiae about as long as femora, all margins carinate. Tarsi with metatarsus equal to about the two succeeding articles, ultimate article slightly longer, claws, arolium and pulvilli as in anterior tarsi.

Posterior femora about as long as pro- and mesonotum together; all margins with spaced serrations. Tibiae about as long as femora, margins carinate. Tarsi essentially the same as anterior tarsi.

⁵⁸ We are not describing the extremity of the abdomen as the type is immature.

General color ochraceous tawny, with portions of occiput, major elements of armature and serrations of limbs varying to emerald green, median portion of meso- and metapleura hessian brown; venter light fuscous varying laterally to darker fuscous; claws blackish.

Length of body, 41.5 mm.; length of pronotum, 3; length of mesonotum, 8; length of metanotum, 5; length of median segment, 3; length of anterior femur, 8.8; length of median femur, 7.5; length of posterior femur, 10.8.

Allotype. — Juv. ♀; Calian, Davao Province, Mindanao. May 29, 1930. (C. F. Clegg.) [Hebard Collection.]

General size relatively small, and rather broad for the genus; quite spiny, major elements of armature quite conspicuous, often compound, general surface with scattered low tubercles.

Head subrectangulate, a little longer than broad; eyes relatively prominent, subglobose; supra-orbitals, occipitals, median and lateral coronals all relatively prominent spinose, supra-orbitals largest, gulars represented by a few relatively low spinose tubercles; general surface with low tubercles in a more or less geometrical arrangement.

Pronotum half as long as mesonotum, longer than broad, anteriors present, spinose, posteriors large, spinose, trifold, antero-lateral angles with relatively large blunt tubercles, laterals represented by low tubercles, supra-coxals, three or four relatively large spines; general surface with low tubercles.

Mesonotum elongate, a little less than twice as long as broad; anteriors and medials, simple, relatively large, spinose; posteriors decidedly compound; before the medials a large pair of laterals on each of the mesonotal margins; general surface with scattered low tubercles and granules. Mesopleura with mesopleural large, spinose, bifid with more ventral element longer; laterals and supra-coxals irregular, varying from low tubercles to rather prominent spines. Mesosternum with posterior sternal very low, mesosternals rather numerous, low, tuberculate.

Metanotum a little longer than pronotum; posteriors relatively prominent, decidedly compound, spinose, a few small lateral tubercles; general surface with low tubercles. Metapleura with two mesopleurals, more ventral one larger; laterals and supra-coxals quite prominent, large, spinose, largest immediately above the coxae. Metasternum with a faint indication of a medio-longitudinal carina; fossae subcircular, completely cingulate; anterior to fossae metasternals tuberculate, a few small tubercles near inner margin of fossae. Median segment with medials and a full posterior series of small tubercles, anteriors subobsolete tubercles; general surface with low tubercles.

Abdominal tergites transverse; basal tergites with anteriors, medials, first and second paired posteriors spinose as well as a pair of spinose tubercles near the lateral margin in the middle of the tergite; indications of a paired row of low tubercles along medio-longitudinal line; fifth to ninth tergites with a medio-posterior specialization which gradually increases from a small node to a subrostrate produced specialization.⁵⁹

Limbs essentially as in type, except that the anterior femora have the dorso-anterior margin with a few spaced serrations throughout its length.

⁵⁹ As this individual is immature we are not describing the apex of the abdomen; however, the apex of the supra-anal plate is weakly emarginate.

General color buckthorn brown, with abdomen varying to chestnut brown; many of the elements of the armature, particularly of the thorax, black.

Length of body, 60.2 mm.; length of pronotum, 4.5; length of mesonotum, 10.2; length of metanotum, 5; length of median segment, 3.5; length of anterior femur, 11; length of median femur, 10; length of posterior femur, 13.5.

The pair of this interesting species is unique.

Euobrimus cavernosus (Stål)

Plate 31, fig. 8; pl. 36, fig. 38; pl. 38, fig. 44.

1877. *O[brimus] cavernosus* Stål, Ann. Soc. Ent. Belg., XX, p. lxxviii. [♀; "Insulae Philippinae".]

1895. *Alcanthoderus] cavernosus* Elera, Fauna Filipinas, II, p. 200.

1904. *O[brimus] cavernosus* Kirby, Syn. Cat. Orth., I, p. 398.

1906. *O[brimus] cavernosus* Redtenbacher, Insektenfam. Phasm., I, p. 39, pl. I, fig. 6. (In part; relevant sex and pertinent locality not evident from context; "Philippinen, Luzon, Mindanao".)

1915. *Obrimus cavernosus* Bruner, Univ. Neb. Studies, XV, no. 2, p. 229.

1933. *Obrimus cavernosus* Sjöstedt, Arkiv för Zool., 25A, no. 16, p. 2.

This species, which has been confused, at least in part, by both Redtenbacher and Dohrn, is closely related to *bakeri*, *dohrni* and *lacerta*. The male of *cavernosus* has the posterior pro-, meso- and metanotals large, simple and spinose; the meso- and metapleurals strong, simple, tuberculate; general surface smooth; this combination of characters will readily separate it from any of the other known forms. In the female the post-medial mesonotals are spinose; posterior pronotals simple, posterior meso- and metanotals cristate; proximal abdominal tergites with anteriors, medials, second paired posteriors and medio-laterals all present and spinose.

This species is known definitely only from northern Mindanao (Surigao) and the small island of Siargao, which is off the coast of northeastern Mindanao.

Specimens examined. — 6; 4 ♂, 2 ♀.

SIARGAO: 1 ♂, 2 ♀; [Hebard Cln.].

MINDANAO: Surigao; (Baker); 2 ♂; [U.S.N.M.]: 1 ♂; [Hebard Cln.].

Euobrimus lacerta (Redtenbacher)

1906. *O[brimus] lacerta* Redtenbacher, Insektenfam. Phasm., I, p. 39. [♂ not ♀; "Philippinen, Luzon, Mindanao".]

1915. *Obrimus lacerta* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

This species, based on both sexes, doubtless from different islands, is apparently composite. Dohrn⁶⁰ has voiced his opinion that this is the case, and we are referring to his comments under *E. dohrni*. To secure fixity in the use of the name *lacerta*, we have restricted it to the male sex as described by Redtenbacher. We are unable to say whether the material of that sex studied by him came from Luzon or Mindanao, as he followed the reprehensible practice of many of his contemporaries of not giving exact

⁶⁰ Stett. Ent. Zeit., 71, p. 397, (1910).

and definite information on the specific sources of his material. It is our opinion, however, that his males came from Luzon, and the females from Mindanao, judging from Dohrn's comments.

As we do not know this species we can but repeat the following information modified from Redtenbacher. Occiput with eight large, acuminate tubercles, arranged in two transverse series. Pronotum bispinose, anterior angles brevispinose. Mesonotum anteriorly and posteriorly with four spines also posterior angles spinose, lateral margins spinose. Metanotum spinose laterally, dorsum with four spines. Abdomen smooth, carinate, without large spines. Ultimate tergite incised, lobes rounded. Sterna densely and finely tuberculate. Metasternum with large deep foramina.

Euobrimus dohrni new species

1906. *O[brimus] cavernosus* Redtenbacher, Insektenfam. Phasm., I, p. 39. (In part; relevant sex and pertinent locality not evident from context; "Philippinen, Luzon, Mindanao".)

1906. *O[brimus] lacerta* Redtenbacher, Insektenfam. Phasm., I, p. 39. (In part; relevant sex and pertinent locality not evident from context; "Philippinen, Luzon, Mindanao".)

1910. *Obrimus cavernosus* Dohrn, Stett. Ent. Zeit., 71, p. 397. [♂, ♀; Mindanao.]

This form, which has been confused with *cavernosus* (Stål) and *lacerta* (Redtenbacher), is closely related to these forms, as well as to *bakeri*. The male of *dohrni* has the proximal abdominal tergites armed with paired spines; head lacking occipitals; posterior pro- and metanotals simple, lateral mesonotals absent, as in the male of *bakeri*, but differs from the latter by having the mesopleura with antero-laterals and the posterior mesonotals trispinose. The female of *dohrni* is most closely related to *bakeri* and agrees with it by having the posterior pro-, meso- and metanotals simple and spinose; anterior pronotals absent; median mesonotals spinose; but differs from it by having four spines arranged in a trapezoid on abdominal tergites 2 to 6 instead of having only the anteriors on the basal segments, moreover, the mesonotum has twelve spines arranged in three transverse rows, a condition unknown in any of the other members of the genus.

Euobrimus hoplites⁶¹ new species

Text-figure 6.

This distinctive species is nearest to *E. dohrni* and *bakeri*, but may be readily separated from either of these forms by having tuberculate occipitals and supra-orbitals, the antero-lateral mesopleurals being low tuberculate, while the median mesonotals are spinose tubercles and the posterior meso- and metanotals are simple, moreover, the mesopleura have several spaced, tuberculate laterals. The present form is the most slender and delicate species of the genus, yet the major elements of the armature seem more prominent than usual.

⁶¹ From ὀπλίτης — heavily armed.

Type.—Juv. ♂; Samar, Philippines. (Baker.) [Hebard Collection, Type no. 1342.]

General form relatively slender and light, rather small for the genus; major elements of armature rather prominent, general surface with scattered granules.

Head subrectangulate, a little longer than broad; eyes rather prominent, obovate; antennae with basal article flattened, triquetrous, second article relatively short, barrel-shaped, remaining articles subcylindrical, averaging longer proximad; supra-orbitals, occipitals and median coronals tuberculate, lateral coronals larger, tuberculate, gulars faintly indicated; general surface with numerous scattered granules.

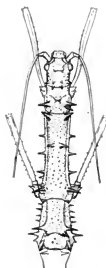
Pronotum rectangulate, a fourth longer than broad; posteriors rather strong, spinose tuberculate, a smaller tubercle behind dextral posterior; transverse sulcus rather faint, concave posteriorly; antero-lateral angles with a subobsolete rounded tubercle; general surface with scattered, low rounded tubercles.

Mesonotum elongate, almost four times as long as broad; anteriors, medians and posteriors simple spinose tubercles, relatively prominent, a rounded subobsolete medio-lateral; general surface with scattered low granules. Mesopleura with mesopleurals rather prominent, about as large as mesonotal posteriors, antero-lateral subobsolete, tuberculate, three or four laterals in posterior two-thirds, rather prominent, tuberculate; surface with scattered granules. Mesosternum with mesosternals subobsolete, irregular, surface with a few scattered granules.

Metanotum with posteriors rather prominent, spinose tubercles, behind dextral one a smaller tubercle; surface with scattered granules. Metapleura with metapleurals rather prominent, much as mesopleurals, laterals and supra-coxals relatively strong, spinose tubercles; surface with scattered granules. Metasternum with metasternals irregular, fossae elongate elliptical, completely cingulate. Median segment with faint indications of medials and first and second paired posteriors; surface with low granules.

Abdominal tergites basally subrectangulate, about one and one-third times as long as broad, apically transverse; second and third tergites, including median segment in count, with anteriors rather strong, remaining tergites with anteriors represented by subobsolete tubercles.⁶²

Anterior femora relatively short and slender, as long as mesonotum, basal flexure evident, all margins carinate, with low spaced serrulations or serra-



TEXT-FIGURE 6.—*Euobrimus hoplites* new species. Dorsal aspect of head and thorax of male (type). Samar. ($\times 1\frac{1}{2}$.)

⁶² As the type is immature we are not describing the apex of the abdomen, but it is evident that the terminal tergites have a medio-longitudinal specialization which probably is quite evident in adults.

tions. Tibiae about as long as femora, all margins carinate. Tarsi as in related forms.

Median femora quite short and relatively stocky, shorter than mesonotum; all margins carinate and with low, spaced serrulations or serrations. Tibiae much as anterior tibiae, and tarsi as in the other members of the genus.

Posterior femora rather slender, a little longer than the mesonotum, margins essentially as those of median femora. Tibiae and tarsi essentially as those of median leg.

General body color dark fuscous, with limbs clay color.

Length of body, 53.2 mm.; length of pronotum, 3.5; length of mesonotum, 11.3; length of metanotum, 5; length of median segment, 2.3; length of anterior femur, 11; length of median femur, 10; length of posterior femur, 13.

This species is known only from the unique type.

Euobrimus bakeri⁶³ new species

Plate 35, fig. 32; pl. 37, fig. 39.

This species, which is in the general *cavernosus* complex, is in all probability most nearly related to *dohrni* and *hoplites*. The male of *bakeri* agrees with *dohrni* and *hoplites* in the character of most of its armature, and particularly in the possession of paired anterior spines on the proximal abdominal tergites, while it differs from *hoplites* by lacking occipitals and from *dohrni* by having simple spinose posteriors on the pro-, meso- and metanotum, as well as by lacking antero-lateral mesopleurals. In the female sex *bakeri* is quite closely related to *dohrni* but differs from the latter by having only simple, spinose anterior, median and posterior mesonotals, and has only anteriors on the proximal abdominal tergites, as well as having the apex of the ultimate tergite incised.

Type.—♂; Samar, Philippines. (Baker.) [United States National Museum.]

General size rather slender and relatively elongate for the genus; surface with small granules but appearing rather smooth, except for the large prominent spinose elements of the armature.

Head rectangulate, a little longer than broad; eyes subcircular, bulbous, very prominent; antennae as in related species; median and lateral coronals rather prominent, tuberculate, occipitals barely evident as subobsolete granules, postero-lateral angles of head rectangulate with a rather large and prominent tubercle; surface rugose with small scattered granules.

Pronotum rectangulate, rather elongate, being a little more than one and one-third times as long as broad; posteriors very prominent, simple, elongate, narrowly rounded, spinose, their height equal to half the pronotal length; transverse sulcus rather faint, truncate medially, immediately before it on each side of the medio-longitudinal line is a rounded tubercle, antero-lateral angles with a very low rounded tubercle; general surface comparatively smooth.

⁶³ In memory of the late Dr. Charles Fuller Baker, former Dean of the College of Agriculture of the Philippine Islands, to whose labors and enthusiasm a large part of our present knowledge of the insect life of the Philippines is due.

Mesonotum quite slender and elongate, its length being four times its greatest width; anterior mesonotals simple elongate spines as long as posterior mesonotals, posteriors simple, spinose, with the apex narrowly rounded, their length being greater than that of posterior pronotals, a very low ridge encloses the base of the former; general surface with numerous small granules. Mesopleura with mesopleurals essentially as mesonotal posteriors, laterals represented by spaced, low, subobsolete tubercles; surface granulose. Mesosternum with a slight tendency toward a medio-longitudinal carina. Mesosternals not recognizable from the scattered granules that cover the surface.

Metanotum with posteriors essentially like mesonotal posteriors but even longer, surface with scattered granules. Metapleura with metapleurals much as mesopleurals but longer, laterals represented by low, spaced tubercles, supra-coxals by spinose tubercles, surface granulose. Metasternum with a tendency toward a medio-longitudinal carina; fossae present as elongate elliptical pits which are completely cingulate; surface granulose. Median segment with low scattered granules.

Abdominal tergites subquadrate proximad, elongate rectangulate posteriorly, second and third tergites, including median segment in count, with elongate anterior spines, these spines as long as metapleurals, anteriors of fourth tergite low, subobsolete, rounded tubercles; seventh tergite with a low trifoliate elevation medio-posteriorly; eighth tergite with lateral margins obliquely divergent, medio-posteriorly with a low node; penultimate with these margins obliquely convergent but at posterior margin more remote than at posterior margin of seventh; ultimate tergite with lateral margins parallel proximad, then weakly concave mesad, posterior margin incised. Poculum⁶⁴ in lateral view more or less trigonal, at ventro-posterior angle a transverse carina.

Anterior femora quite slender, a little longer than mesonotum, basal flexure evident on both margins; all margins carinate, dorso-anterior with low, spaced serrulations, ventro-anterior with spaced, low serrations in distal half. Anterior tibiae about as long as femur, very slender, all margins carinate. Anterior tarsi as in related forms.

Median femora rather slender and elongate, about as long as mesonotum, dorsal margins feebly carinate, ventral ones feebly carinate and with low, spaced nodes. Tibiae slender, about as long as femora, all margins carinate, flexor ones armed with spaced spinules, median carina of flexor surface with a few spinules. Tarsi much as anterior tarsi.

Posterior femora quite slender and elongate, about as long as pro- and mesonotum, all margins feebly carinate, ventral ones with low spaced nodes, dorso-posterior with a few very low nodes. Tibiae slender, about as long as femora, flexor margins with low spaced serrulations, as is median carina of this surface. Tarsi as in related forms.

General color varying from fawn color to army brown, and passing to natal brown on portions of the abdomen, venter and limbs; lateral portions of mesonotum, mesosternum and mesopleura a dull shamrock green.

Length of body, 64 mm.; length of pronotum, 4.5; length of mesonotum, 15.5; length of metanotum, 6; length of median segment, 3.5; length of anterior femur, 17; length of median femur, 15; length of posterior femur, 19.5.

⁶⁴ The poculum of the unique male is damaged by being compressed.

Allotype. — ♀; Same data as type. [United States National Museum.]

General size about average for the genus, rather slender; general surface rugoso-granulate, elements of armature quite prominent.

Head subrectangulate, a little longer than broad; eyes subcircular, fairly prominent; antennae as in male; median and lateral coronals low tuberculate, occipitals subobsolete rounded tubercles, postero-lateral angles of head rectangular with a low rounded tubercle, general surface rugose with scattered low granules.

Pronotum rectangulate, a third again as long as broad; posteriors simple, strongly spinose; transverse sulcus as in male and preceded by a pair of low rounded tubercles; antero-lateral angles with a low tubercle; general surface with numerous scattered granules.

Mesonotum rather elongate, three times as long as broad; anteriors, medians and posteriors simple, spinose, medians smaller, posteriors arising from a subobsolete crest or ridge, which has slight indications of subobsolete lowly rounded tubercles; general surface with numerous scattered granules. Mesopleura with mesopleurals simple, strongly spinose; laterals, in posterior portion, low tuberculate; general surface with numerous low scattered granules. Mesosternum with a faint indication of a medio-longitudinal carina, mesosternals low tuberculate; general surface with scattered granules.

Metanotum with posteriors simple, spinose, essentially like mesonotal posteriors; surface with scattered granules. Metapleura with metapleurals spinose, about as long as mesopleurals, laterals tuberculate, supra-coxals low tuberculate except for one considerably larger tubercle immediately ventrad of metapleural. Metasternum with two pairs of low tuberculate metasternals on anterior portion of sternum; fossae elongate elliptical pits which are completely cingulate. Median segment with a faint indication of medials, surface with scattered low granules.

Abdominal tergites rectangulate varying from slightly broader than long (proximal ones) to broadly transverse (distal ones), second and third, including median segment in count, with paired spinose anteriors, these are quite prominent and rather elongate; fifth to ninth tergites with a medio-posterior node which is progressively larger posteriorly, ninth tergite with postero-lateral angles acute-angulate produced; penultimate tergite with lateral margins bisinuate, convergent posteriorly, lateral portions of posterior margin convex but with a distinct median incised area; ultimate tergite relatively short and broad, lateral margins weakly convergent posteriorly, apex weakly concave. Penultimate sternite with a transverse elevated area in median portion of posterior margin; opereculum (ultimate sternite) elongate linear, with a medio-longitudinal carina in apical four-fifths, with numerous transverse rugae, surpassing ultimate tergite, immediate apex broken.⁶⁵

Anterior femora relatively short and slender, a little longer than mesonotum, basal flexure evident on both margins, all margins carinate, anterior ones in distal half with spaced serrations, those on dorsal margin larger. Tibiae about as long as femora, all margins carinate. Tarsi as in related forms.

⁶⁵ In a paratypic female the apex is rounded acute-angulate.

Median femora rather short and slender, a little shorter than mesonotum, all margins feebly carinate and supplied with low spaced nodes or serrations. Tibiae and tarsi as in male.

Posterior femora rather elongate, a little shorter than meso- and metanotum, all margins weakly carinate and supplied with spaced nodes or serrations, those on posterior surface being larger. Tibiae and tarsi as in related forms.

General color fuscous with touches of snuff brown on portions of the thorax and limbs.

Length of body, 101 mm.; length of pronotum, 6.2; length of mesonotum, 17.5; length of metanotum, 6.8; length of median segment, 5; length of anterior femur, 18; length of median femur, 16; length of posterior femur, 21.5.

A paratype female from the same locality, which evidently represents the intensive extreme of armature of the species, shows the following noteworthy differences: a spine before the posterior pronotals on the dextral side, this probably being an abnormality, a pair of premedian mesonotal spines, the lateral mesopleurals a little stronger but still tuberculate; median segment with a pair of small median spines, these also present on the second abdominal tergite; paired anterior abdominal spines are on tergites 2 to 4, and 2 and 3 have paired posterior spines; meso- and metasternals slightly more prominent; all the major elements of the armature are more strongly developed, being slightly longer than in the allotype. This individual is also slightly larger in all respects.

This interesting species is known only from the island of Samar.

Euobrimus cleggi⁶⁶ new species

Plate 33, fig. 21; pl. 37, fig. 40.

This species which, in all probability, is most closely related to *cavernosus*, is separable from that, as well as from all the other forms of the genus, by having the posterior meso- and metanotals as suberistate ridges, the individual elements of these being rounded tubercles, not spines or spinose tubercles. The general lack of any definite and prominent spines or spinose tubercles except along the lateral margins of the meso- and metapleura is a characteristic of the present form.

Type.—♂; Libulan River, Mount Apo, Mindanao, Philippines. 2000 feet. November 11, 1930. (C. F. Clegg.) [Hebard Collection, Type no. 1252.]

General size relatively small; surface granular or low tuberculate, not spinose.

Head subquadrate, a little longer than broad; eyes globose, quite prominent; antennae with basal article flattened, second article barrel-shaped, remaining articles elongate, cylindrical; supra-orbitals, occipitals, median

⁶⁶ This species is named for its collector, Mr. Charles F. Clegg, of Barnstable, Massachusetts, who made important Orthoptera collections in the Mt. Apo region of Mindanao.

and lateral coronals all low rounded tubercles, supra-antennals subobsolete; general surface granulose.

Pronotum rectangular, about half again as long as wide; posteriors rounded tubercles; transverse sulcus prominent, medially subtruncate, laterally convex anteriorly; general surface granulose.

Mesonotum elongate, two and one-half times as long as pronotum; anteriors present as low rounded tubercles, posteriors low crests terminating in a single rounded knob; surface granulose. Mesopleura with mesopleurals low, rounded, postero-lateral low, rounded, tuberculate; general surface granular. Mesosternum with a very low postero-sternal swelling; general surface granular.

Metanotum with posteriors low cristate ridges terminating in a low rounded tubercle; surface granular. Metapleura with metapleurals and supra-coxals low, rounded, tuberculate, laterals subobsolete. Metasternum with a low median swelling; fossae irregularly ovate, completely cingulate. Median segment with surface granulose.

Abdominal tergites varying from trapezoidal basally to transverse apically; general surface granular. Ultimate tergite (supra-anal plate) apically narrowly V-emarginate, lateral lobes rounded. Poculum cup-like, in lateral view, subrectangulate, posteriorly V-emarginate, with dorso-lateral margins arcuate.

Anterior femora relatively elongate, almost as long as pro- and mesonotum together; basal flexure present but not prominent on anterior margin, all margins weakly carinate, ventral ones with one or two serrulations or serrations in apical half. Tibiae about as long as femora, all margins carinate. Tarsi with metatarsus about as long as succeeding three articles, ultimate article slightly longer; claws strong, curved, arolium and pulvilli present.

Median femora a little longer than mesonotum, margins with low spaced tubercles, larger on ventral margins and strongest apically. Tibiae about as anterior tibiae. Tarsi as anterior tarsi except that metatarsus is somewhat shorter.

Posterior femora⁶⁷ almost as long as meso-, metanotum and median segment, margins with a few spaced serrulations on dorsal margins, serrations on ventral margins strongest apically. Posterior tibiae and tarsi essentially as anterior ones.

General body color ashy gray, limbs varying from ashy gray to dark fuscous.

Length of body, 45.5 mm.; length of pronotum, 4.8; length of mesonotum, 10; length of metanotum, 4.5; length of median segment, 2.5; length of anterior femur, 12.8; length of median femur, 11; length of posterior femur, 15.2.

Allotype. — ♀; Libulan River, Mount Apo, Mindanao. 2000 feet. (C. F. Clegg.) [Hebard Collection.]

General size average for the genus; surface granular or low tuberculate, not spinose, except for lateral margins of thoracic pleura.

⁶⁷ One of the posterior limbs has quite evidently been regenerated, as it is considerably smaller than the other and also it lacks all of the usual serrulations or serrations.

Head subrectangulate, about a third longer than broad; eyes rather prominent, subglobose; antennae as in male; supra-orbitals, occipitals, median and lateral coronals rounded tuberculate, supra-antennals subobsolete, posterior portion of gular series represented by low rounded tubercles; general surface with scattered granules.

Pronotum rectangulate, a little longer than broad; posteriors rounded tubercles, anteriors low and rounded, before posteriors a pair of low rounded tubercles, a lateral series of low rounded nodes, medio-longitudinally a paired row of low tubercles; transverse sulcus moderately prominent, medially subtruncate; general surface with numerous low scattered tubercles and granules.

Mesonotum elongate, a little more than twice as long as broad; anteriors low rounded, medials subobsolete nodes, posteriors suberistate ridges terminating in a rounded tubercle with several smaller tubercles surrounding it, these more strongly developed in a longitudinal line, medio-laterals low tuberculate; surface with numerous granules. Mesopleura with mesopleurals tuberculate, laterals subobsolete except for medio-lateral and two postmedian laterals which are tuberculate, antero-lateral rather strong, tuberculate, postero-lateral small tuberculate; surface granular. Mesosternum with mesosternals irregular, tuberculate; surface weakly granular.

Metanotum with posteriors essentially as mesonotal posteriors; general surface granular. Metapleura with metapleurals tuberculate, smaller than mesopleurals, laterals and supra-coxals relatively prominent, tuberculate; surface granular. Metasternum with metasternals subobsolete in anterior portion; fossae irregularly ovate, completely cingulate, with a low tubercle on postero-lateral portion of margin. Median segment with medials subobsolete; general surface granulate.

Abdominal tergites broadly transverse; latero-anteriors tuberculate; posterior median low tuberculate, preceded by one or two pairs of subobsolete tubercles, first and second paired posteriors subobsolete; antero- and postero-lateral portions of tergites often with a low tubercle, occasionally with a low tubercle in the medio-lateral portions; seventh tergite, including median segment in count, with a low node on posterior portion of median line, a faint indication of this on fifth and sixth tergites, eighth with a decided node, ninth with this node higher but truncated posteriorly; penultimate tergite with posterior half of lateral margin concave, lateral portion of posterior margin obliquely truncated, median portion weakly bilobate, emarginate mesad; ultimate tergite half again as long as penultimate tergite, linear, lateral margins weakly convergent to the truncate apex; penultimate sternite with a medio-posterior depressed cup-shaped area, preceded by a subtransverse broad carina and its lateral margins bounded by carinae that become obsolete posteriorly;⁶⁸ operculum elongate, linear, surpassing ultimate tergite, with a distinct medio-longitudinal carina from proximal fifth, also numerous supplementary carinulae; immediate apex acute angulate, feebly rounded.

Anterior femora relatively stout, a little longer than mesonotum, basal flexure evident on both margins; all margins carinate, anterior ones beyond flexure serrate, dorso-posterior serrate throughout, ventro-posterior with low

⁶⁸ There is a somewhat similar area on the ultimate sternite of *cavernosus*, but the area is more flattened and the carinae are much less evident.

spaced serrations. Tibiae about as long as femora, all margins carinate and supplied with low spaced serrations. Tarsi as in male.

Median femora relatively stout, a little shorter than mesonotum, all margins carinate and serrate. Tibiae about as long as femora, all margins carinate, flexor with spaced serrations. Tarsi as median tarsi of male.

Posterior femora rather stout, almost as long as pro- and mesonotum, posterior limbs essentially as median ones.

General color varying from wood brown to army brown, a medio-longitudinal streak of avellaneous, numerous granules and low tubercles tipped with black.

Length of body, 98 mm.; length of pronotum, 6.8; length of mesonotum, 15.6; length of metanotum, 6.5; length of median segment, 4.5; length of anterior femur, 17.5; length of median femur, 15; length of posterior femur, 21.

The pair of this interesting species from the lower slopes of Mount Apo is unique.

MEARNSIANA new genus ⁶⁹

This distinctive and remarkable new genus, which is not closely related to any of the known genera, is characterized by a combination of structures unique in the tribe Obrimini. While the nearest relationship is with *Obrimus* and *Arcteon*, the limitations of a linear arrangement prevent us from placing it in their neighborhood. It differs materially, however, from either of these by having the following combination of characters; posterior meso- and metanotals large conical elevated tubercles with numerous supplementary rounded tubercles, posterior metanotals connected by a transverse elevated ridge, while the femora have the ventral margins produced into serrate laminations.

Generic characters.—Form quite short and stocky, granular in appearance and with rather short and very stocky legs; no definite spines on body, all major elements of armature represented by rounded tubercles, or at most, as on lateral margins of pleura, by spinose tubercles; posterior pronotals relatively large conical elevations, posterior mesonotals large conical elevations terminating in a rounded knob, posterior metanotals of same general type but not as elevated, yet connected by a transverse ridge; terminal abdominal tergites with a medio-longitudinal carina, terminating on each in an elevated, rounded, posteriorly directed node; prosternum with sensory areas quite far forward, metasternum with slight indications of a marginal fold, the lateral portions set off by a row of low tubercles; femora with ventral margins of all but basal half of ventro-anterior of anterior, and ventro-posterior of posterior femora with quite prominent, relatively broad serrate laminations; tibiae with one or both lateral margins of flexor surface

⁶⁹ Dedicated to its collector, the late Major Edgar A. Mearns, U.S.A., surgeon and zoologist, whose service in the Philippines enabled him to add very greatly to our knowledge of the vertebrate life of the islands. In early service in our western states, on the Mexican Boundary Survey and with Theodore Roosevelt in Africa, Dr. Mearns was ever the naturalist, adding to our knowledge of the life of those lands.

serrate, often appearing sublaminate; tarsi with metatarsus exceedingly short for the tribe, being at most only half as long as ultimate article, the latter quite large and supplied with very large curved claws and a large sacular arolium.

Genotype. — *Mearnsiana bullosa* new species.

Known only from the genotype here described.

***Mearnsiana bullosa* new species**

Plate 38, fig. 47.

Type. — Juv. ♂; Mount Apo, Mindanao, Philippines. June-July. (E. A. Mearns.) [United States National Museum.]

Relatively short and heavy, general surface roughened, with numerous irregularly spaced, rounded granules; legs short and heavy, possessing laminations as noted above.

Head subquadrate; eyes prominent, globose; antennae with basal article flattened, second article about half as long, circular in section, remaining articles subcylindrical, slightly longer distad; supra-orbitals and lateral coronals rather large, rounded, tuberculate, occipitals and median coronals smaller, rounded tuberculate, a pair of low rounded tubercles between supra-orbitals and median coronals, gulars represented by two or three low tubercles; general surface weakly granulose.

Pronotum transverse, half again as broad as long; anteriors conical elevated tubercles, with apex broadly rounded, posteriors as described under the genus; antero-laterals subobsolete, rounded; transverse sulcus prominent, concave posteriorly; general surface including that of elevated anteriors and posteriors with low, scattered granules.

Mesonotum almost subquadrate, faintly longer than broad; anteriors at anterior margin, rather heavy, rounded tuberculate, posteriors as described under the genus, with the area between them somewhat elevated, a few low lateral tubercles; general surface, including that of posterior elevations with scattered, low rounded tubercles and granules. Mesopleura with mesopleural subobsolete, represented by a very low rounded tubercle, laterals rather prominent, tuberculate to spinose tuberculate; general surface with scattered low tubercles and granules. Mesosternum with a raised tuberculate carination somewhat removed from and parallel to the lateral margins, area between this and lateral margins quite smooth, pleura tending to fold over this area; a low postero-sternal swelling; central portion of mesosternum with scattered, rounded granules.

Metanotum transverse, with posteriors as described under the genus, general surface as well as that of conical elevations with low rounded granules. Median segment broadly transverse, with very faint indications of various elements of armature but these not differentiated from the low granules that are scattered over the surface. Metapleura with laterals and supra-coxals quite evident, former tuberculate, latter stronger and usually spinose tuberculate; general surface with scattered granules. Metasternum with low tuberculate carinae near lateral margins, the lateral, marked off, areas gently sloping under the infolded pleural margins; central area with a few scattered granules; apodemal fossae rather prominent, elliptical, bounded laterally by a carina that runs posteriorly to the posterior margin and anteriorly curves mesad and becomes obsolete; a low median swelling.

Abdomen with tergites transverse; a full posterior series evident on all tergites, postero-mesal divided on basal ones, from fifth on becoming progressively more elevated until, in lateral aspect, it becomes subrostrate produced, median line of basal tergites often with low paired tubercles, apical tergites with a raised medio-longitudinal carina; lateral margins of tergites produced into broad flaps, these becoming larger and more prominent apically.⁷⁰

Anterior femora rather short and very stocky, shorter than pro- and mesonotum; all margins carinate, dorsal ones with spinose serrations scattered throughout their length, ventro-anterior in apical half and ventro-posterior produced into prominent lamellate plates with their margins irregularly serrate. Tibiae distinctly shorter than femora, all margins carinate, flexor ones with irregular serrulations. Tarsi as described under the genus.

Median femora quite short and heavy, as long as the mesonotum; all margins carinate, dorsal ones with irregularly spaced spinose serrations, ventral ones produced into rather broad lamellate plates whose margins are irregularly serrate. Tibiae distinctly shorter than femora; margins rounded carinate, except for posterior flexor margin which has irregular serrations. Tarsi essentially as anterior ones except that the metatarsus is even shorter.

Posterior femora relatively short and rather heavy, a little shorter than meso- and metanotum; all margins carinate, dorsal ones with irregularly placed spinose serrations, ventro-anterior produced into a laminate plate with an irregularly serrate margin, ventro-posterior with a few spaced spinose serrations. Tibiae distinctly shorter than femora, all margins carinate, flexor ones with irregular serrations. Tarsi essentially as anterior tarsi.

General color light tan with conical elevations of meso- and metathorax dark fuscous, and numerous scattered fuscous patches on dorsum, particularly around elements of the armature. Femora and tibiae with one or more bands of clay color across general fuscous ground color. Venter clay color.

Length of body, 30.5 mm.; length of pronotum, 2.6; length of mesonotum, 5.3; length of metanotum, 3; length of median segment, 2; length of anterior femur, 6.5; length of median femur, 5.3; length of posterior femur, 7.5.

This curious and highly specialized form from Mount Apo is known only from the immature male here described.

ILOCANO new genus⁷¹

Genotype. — *Ilocano hebardi* new species.

The members of this distinctive genus superficially resemble the more usual members of the Datamini in their general body build and more general lack of prominent armature. However, they are, in reality, a group that shares some of the characters of the true obrimoids and those of the *Hoploclonia* complex. The genus is quite distinct from all the others of the tribe, but is probably most nearly related on one hand to the primitive genus

⁷⁰ As the type is immature we are not describing the apex of the abdomen.

⁷¹ Named after the Ilocanos, one of the dominant Philippine races of the Malayan stock.

Eubulides and on the other to *Hoploclonia*. From these, however, it may very easily be separated by possessing the following combination of characters: lacking anteriors or posteriors on any of the thoracic tergites, but with paired posteriorly convergent lines of low tubercles on the pronotum and with paired carina on the anterior portion of the mesonotum; the operculum is straight in profile, and is not elongate; limbs are rather short and quite slender; moreover, as far as is known the antennae in the members of this genus are not as long as the anterior legs.

Generic characters.—General size relatively short and rather stocky, surface more or less smooth except for definite elements of armature, legs quite short and slender; head with either distinct spine arrangement or with both crests and spines on the inter- and post-orbital areas; antennae shorter than anterior legs; pronotum with two, posteriorly convergent, granulate carinulations, antero-lateral angles somewhat produced; mesonotum with a low, at times granulated, medio-longitudinal carina, anteriorly with paired lateral, either curved or posteriorly convergent, granulate carinulae; mesopleura with rounded subobsolete laterals; metanotum with faint indications of a medio-longitudinal carina; metapleura at least somewhat dilated before the coxal region; abdomen with a definite medio-longitudinal carina, which may be granulated; operculum straight in profile, and quite short, reaching to or slightly surpassing ultimate tergite which is quite short and rather broad, not more than one and one-half times as long as basal width; legs with metatarsus quite short, usually only as long as succeeding two articles.

Key to Species

1. Head with a low post-orbital crest, without supra-orbital spines; mesonotum with slight indications of a medio-longitudinal carina, with paired posteriorly convergent lateral carinae in anterior third; without a very distinct supra-coxal metapleural angulation.

hebardii new species

Head without a post-orbital crest, but with supra-orbital spines; mesonotum with a granulated medio-longitudinal elevated ridge, with curved lateral carinae; with a distinct supra-coxal angle on metapleura *ranarius* (Westwood)

Ilocano hebardii ⁷² new species

Plate 31, fig. 3.

This diminutive species may be separated from Westwood's *ranarius* by its small size, the possession of low, sublunate post-orbital crests instead of being armed with tubercles, the antero-lateral angles of the pronotum produced as binodose lobes, while instead of the angles of the pronotum being acutely produced and lacking anteriors the pronotum has faintly developed, tuberculate anteriors. The lateral mesonotal carinae are obliquely convergent posteriorly instead of being curved, and the medio-longitudinal line of the mesonotum has only a trace of a carina, instead of a definitely granulate medio-longitudinal one.

⁷² Dedicated to our colleague, Mr. Morgan Hebard, Research Fellow in Entomology of the Academy, to whose energy and interest we are indebted for the opportunity to study the greater part of the series here discussed.

Type. — ♀; Baguio, Benguet, Luzon, Philippines. July 1923. (E. H. Taylor.) [Hebard Collection, Type no. 1343.]

General size quite small; form rather stout, legs exceedingly short and very slender; general surface texture minutely subgranulose.

Head rectangulate, about half again as long as broad; eyes subglobose, not prominent; antennae with basal article triquetrous, second article subcylindrical, about half as long as basal article, remainder of antennae lost; distinct post-orbital sublamineate crests, somewhat mesad of eyes and extending from a line through posterior margin of eyes practically to the posterior margin; median and lateral coronals low, tuberculate, occipitals practically subobsolete, tuberculate; general surface faintly subgranulose.

Pronotum transverse, slightly broader than long; paired posteriorly convergent rows of low granulations slightly irregular, anteriors low tuberculate, in middle of pre-sulcal area, posterior margin with a pair of low tubercles; antero-lateral angles produced into a low binodose lobe, indications of a rounded lateral tubercle in posterior fifth; anterior margin shallowly concave, with mesal portion subtruncate, median sulcus slightly behind middle, transverse, posterior margin feebly convex; general surface relatively smooth.

Mesonotum rectangulate, about half again as long as pronotum; faint indications of a medio-longitudinal carina, lateral, posteriorly convergent carinae evident in anterior two-fifths, terminating anteriorly and posteriorly in low rounded tuberculate nodes; general surface granulose. Mesopleura slightly dilated posteriorly, laterals represented by spaced low rounded nodes. Mesosternum subdeplanate with faint indications of a medio-longitudinal and lateral carinae.

Metanotum transverse, a little shorter than pronotum; very faint indications of a medio-longitudinal carina; general surface subgranulose. Metapleura somewhat dilated before the coxal regions with an obtuse angulation, a low tubercle near angulation; surface subgranulose. Median segment broadly transverse, subgranulose. Metasternum simple.

Abdominal tergites broadly transverse, with a medio-longitudinal carina becoming more prominent distad, on eighth and ninth tergites vertically declivous posteriorly, all tergites with numerous low granulations. Penultimate tergite with paired elliptical nodes on either side of medio-longitudinal carina near anterior margin, lateral margins bisinuate convergent in posterior half, posterior margin weakly convex. Ultimate tergite one and one-half times as long as broad, with lateral margins weakly and subsinuate convergent to the feebly rounded posterior margin. Operculum slightly surpassing ultimate tergite, straight in profile, navicular, a distinct mid-ventral carina in posterior two-thirds, immediate apex narrowly rounded, acute-angulate.

Anterior femora a little longer than mesonotum; all margins carinate, basal flexure rather prominent on anterior and evident on posterior margin, extending for two-thirds the length of the femora, all margins with occasional low nodose lobes. Tibiae a little shorter than femora, all margins carinate. Tarsi with metatarsus about as long as succeeding two articles, ultimate article slightly longer, claws rather large, curved, arolium scarcely noticeable.

Median femora slightly shorter than anterior femora, all margins roundly carinate. Tibiae and tarsi essentially as anterior ones.

Posterior femora as long as meso- and metanotum; limb essentially as median one, except for tarsus which is lacking.

General color fuscous with a slightly darker medio-longitudinal stripe, legs and venter slightly lighter; tarsal claws tipped with reddish brown.

Length of body, 30 mm.; length of pronotum, 3; length of mesonotum, 4.8; length of metanotum, 2.2; length of median segment, 1.5; length of anterior femur, 6; length of median femur, 5.5; length of posterior femur, 7.

This curious species is known only from the female type.

Ilocano ranarius (Westwood)

1859. *Acanthoderus ranarius* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 53, pl. 4, fig. 3. [♀; "Insulis Philippinensibus".]

1904. *Tilisamenus* (?) *ranarius* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Heterocopus ranarius* Redtenbacher, Insektenfam. Phasm., I, pp. 42, 43. [♀; "Philippinen".]

1915. *Heterocopus ranarius* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 299.

This interesting species may be distinguished from *hebaridi*, the only other member of the genus, by its larger size, and by having the head armed with supra-orbital spines, and the anterior angles of the pronotum acutely produced. The pronotum has oblique posteriorly convergent carinae, the lateral granulate mesonotal carinae are curved and there is a definitely granulate medio-longitudinal carina.

When Westwood originally described this form he did not have it from an exact locality in the Philippine Islands and neither did Redtenbacher in 1906, hence its exact habitat remains unknown.

PTEROBRIMUS Redtenbacher

1906. *Pterobrimus* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 43.

Genotype (by monotypy). — *Pterobrimus depressus* Redtenbacher.

If Redtenbacher's generic diagnosis is correct, then his placing of this genus is erroneous, as the members of this subfamily which have the first antennal article spined, or dentate, belong to the Datamini or section 1.1 of his key, but as he does not say whether the prothoracic foramen is at the latero-anterior angle of the pronotum, or if it is removed from this angle, nor whether the anterior mesosternal plate has or lacks a raised sensory area, we can only refer this genus with some doubt to the Datamini. However, there is considerable doubt in our minds whether this genus is a member of the Obriminae. If it is a member of this assemblage it is undoubtedly one of the most primitive representatives, as it is the only genus which has even a trace of tegmina. We would suggest, however, that a close examination of the type material probably will show *Pterobrimus* to be a member of one of the other subfamilies which have alate forms.

This genus may be characterized by the following features drawn from Redtenbacher's description: proximal antennal article triquetrous with the apex produced into a tooth; pronotum rugose or supplied with two anteriorly divergent tuberculate carina which enclose a triangular area; tegmina present, small, lobiform.

Pterobrimus depressus Redtenbacher

1906. *Pterobrimus depressus* Redtenbacher, Insektenfam. Phasm., I, p. 43. [♂, ♀; "Fidji-Inseln".]

This species is known only from the original material and recorded only from the Fiji Islands.

HOPLOCLONIA Stål

1875. *Hoplocloonia* Stål, Bihang K. Svenska Akad. Handlingar, II, no. 17, p. 8.
 1875. *Hoplocloonia* Stål, Bihang K. Svenska Akad. Handlingar, III, no. 14, p. 18.
 1875. *Hoplocloonia* Stål, Rec. Orth., III, pp. 50, 92.
 1875. *Tisamenus*⁷³ Stål, Rec. Orth., III, pp. 50, 92.
 1904. *Hoplocloonia* Kirby, Syn. Cat. Orth., I, p. 399.
 1904. *Tisamenus* Kirby, Syn. Cat. Orth., I, p. 399.
 1906. *Hoplocloonia* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 45.
 1906. *Tisamenus* Redtenbacher, Insektenfam. Phasm., I, pp. 36, 43.

Genotype (by monotypy).—*Acanthoderus gecko* Westwood [= *Hoplocloonia gecko* (Westwood)].

An examination of the forms that have been placed in either *Hoplocloonia* or *Tisamenus*, as well as of the several new species here described, has led us to the conclusion that one can not logically separate the members of this complex into two genera. The characteristics used by Stål, when originally proposing *Tisamenus*, and by Redtenbacher in the "Insektenfamilie", are found to be either insufficient or are subject to too great a variation to be of diagnostic value for genera. The character stressed by both of these workers, that is, the margin of the impressed area of the tibiae, the areolate section, is quite variable. The usual condition of this area in a member of this assemblage is as follows: those of the anterior tibiae subtruncate to slightly produced, those of the middle tibiae slightly produced to tuberculate, while those of the posterior tibiae vary from slightly produced to definitely spined but the most common types are either produced or tuberculate. There is considerable variation, among the forms studied, in the type of the margin of the areolate area but it seems to be of some general diagnostic value in some of the groups. Of all the forms examined *H. gecko* is the only one in which this area is terminated in a spine on all the tibiae. When one considers the character of the armature of the metapleura it is evident that this portion of the body shows numerous specific diagnostic

⁷³ The genotype of *Tisamenus* Stål is *T. serratorius* Stål [= *Hoplocloonia serratoria* (Stål)] 1, as designated by Kirby (Syn. Cat. Orth., I, p. 399, (1906)).

features, but the passage from one type to another, such as from unspined to spined, is so gradual that no definite separation can be made. The type of abdominal tergites, whether transverse or not, as well as the characters of the apex of the abdomen, appears to be indicative solely of specific differences. Redtenbacher's attempt to separate these genera on the type of margin of the mesonotal triangular area is found to be inconclusive, the passage from those forms which have the margin of this area barely discernible, through those in which it is granulose and finally carinate, as well as types which have the latero-anterior angles of this area terminated in a low tubercle, through the spinose and finally to the spinose dentate type with either bi- to quadrifid tubercles or spines or with a series of tubercles or spines, is so gradual that no definite division is possible.

This rather large and distinctive genus can immediately be distinguished from all the other genera of the tribe by having a raised, more or less triangular area on the anterior portion of the mesonotum, and by its general body form. To supplement these features the following characterization may be of some value to future workers.

Generic characters.—General form as a rule rather short and stout, usually more or less flattened; surface varying from rather smooth or weakly granulate to strongly spinose; legs quite short and ranging from rather slender to distinctly incrassate. Head rectangulate, longer than broad, with its dorsal surface usually armed either with spines or tubercles or with post-orbital crests or both, the exact armature of this region is a feature of specific importance, other elements of armature are usually present on the lateral portions of the head; eyes globose, usually only moderately prominent though at times quite bulbose; antennae with basal article somewhat flattened, more or less triquetrous, second article usually about half as long, subcylindrical or barrel-shaped, remaining articles subcylindrical, usually a little longer apically, antennae as a whole relatively long, approximating the length of the thorax. Pronotum varying from subrectangulate or subtrapeziform to rather broadly transverse; anterior margin usually concave and posterior one convex to subtruncate, usually with some indication of a raised triangular area on the disk, especially in the pre-sulcal area, the antero-lateral angles of this area often produced into tubercles or spines, simple or compound, or at times into dentate or serrate crests. Prosternum with sensory areas varying from ovoid to elliptical. Mesonotum relatively short and broad, with an elevated triangular area on anterior portion, the extent and proportionate length to width, as well as the type of margins and discal area of this structure are features of specific importance, the antero-lateral angles of this area variously modified, from indistinct nodes to large serrate or denticulate crests, with practically all types between these extremes, at least from posterior margins of triangular area to posterior margin of notum with indications of a medio-longitudinal carina, this at times extremely prominent and granulate, occasionally this carina discernible in the triangular area. Mesopleura with lateral margins varying from denticulate with the laterals represented by low nodes, to forms in which the laterals are strongly spinose, often the mesopleural has migrated laterally

until it is impossible to distinguish it from the laterals; in some forms the supra-coxals have become bifid and the proportionate strength of these elements varies in related forms. Mesosternum ranging from evenly convex to tricarinate, that is with a medio-longitudinal and paired lateral carinae, in the latter type the area between these carina usually relatively flat. Metanotum relatively short and quite broad, with at least an indication of a medio-longitudinal carina, this at times becoming very prominent. Metapleura with lateral margins varying from practically smooth, except for the supra-coxal, to strongly dentate, supra-coxal present and often strongly spinose, at times bifid. Median segment transverse and usually with at least a trace of a medio-longitudinal carina, often with some elements of armature but these are usually rudimentary. Metasternum usually with a medio-longitudinal carina. Abdominal tergites with various elements of armature present or absent, the disposition of these being of specific importance and the apex of the abdomen has features of specific value. Legs usually rather short and varying from slender to incrassate; all margins of femora usually carinate and often with dentations, anterior femora with basal flexure quite prominent; tibiae a little shorter than femora, margins usually carinate, distal margin of arcuate area variable (see preceding discussion regarding *Hoploclonia* and *Tisamenus*); tarsi with metatarsus relatively short, usually approximating length of succeeding two articles, ultimate article usually longer, claws relatively strong, arolium present.

The following key to the species known from the Philippine Islands is in part built from the literature, and it is the hope of the authors that it will be of some assistance to other workers. However, the species of the genus are very closely related and it is difficult to construct a key to them. Many of the forms are known only from one sex, and other species such as those described from Borneo may, and some of these undoubtedly will, be found in the Philippines, hence as a result the key should be used with caution.

The following extra-limital species have been described or placed in this genus; *H. gecko*,⁷⁴ the genotype, and *H. cuspidata*.⁷⁵ It seems quite probable that these two species may form a distinct species group.

Key to the known Philippine Islands Species

1. Inter-posterior mesonotals and median metanotals present, usually strong and often spinose 2
 Inter-posterior mesonotals and median metanotals absent 4
2. Antero-lateral angles of mesonotal triangular area with a simple spine; proximal abdominal tergites with medio-posterior spines 3
 Antero-lateral angles of mesonotal triangular area with either a compound spine or with two or more spines; proximal abdominal tergites without medio-posterior spines *draconina* (Westwood)

⁷⁴ *Acanthoderus gecko* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 52, pl. 26, figs. 6, 7, (1859). [♂, ♀; Sarawak, Borneo.]

We have examined one adult female of this form from the Baram River District of Sarawak, North Borneo, which was taken in 1912 by H. W. Smith. This specimen, which agrees in all essential features with both the original description and figures, is in the collection of the Museum of Comparative Zoölogy.

⁷⁵ *Hoploclonia cuspidata* Redtenbacher, Insektenfam. Phasm., I, pp. 45, 46, (1906). [♀; "Nord-Borneo".]

3. Length of mesonotal triangular area not greater than width across antero-lateral spines of this area; medio-posterior and posterior spines on basal abdominal segments equally developed.
hystrix new species
 Length of mesonotal triangular area distinctly greater than width across antero-lateral spines of this area; medio-posterior much smaller than posteriors on basal abdominal segments *lachesis* new species
4. Meso- and metapleural laterals tuberculate or spinose tuberculate 5
 Meso- and metapleural laterals represented by either subobsolete rounded nodes or tubercles, or these margins denticulate 8
5. Head post-orbitally with paired, relatively low, dentate or serrate crests 6
 Head without post-orbital crests, armed only with spinose or compound tubercles (mesonotal triangular area as long as wide; with less than six mesopleural laterals) *clotho* new species
6. Mesopleura with six strong laterals; metapleura spinose or dentate; posteriorly convergent arms of mesonotal triangular area straight oblique 7
 Mesopleura with at most five laterals, the most posterior really equivalent to the mesopleural; metapleura with two laterals and a bituberculate supra-coxal; posteriorly convergent arms of mesonotal triangular area arcuate *atropos* new species
7. Metapleural bifid, spinose; basal abdominal segments with conical, spinose, paired posteriors *serratoria* (Stål)
 Metapleural spinose, simple, not bifid; basal abdominal segments with small rounded tubercles *aspera* (Bolivar)
8. Mesonotal triangular area broader than long or as broad as long 9
 Mesonotal triangular area at least slightly longer than broad 11
9. Head with paired elevated granulated carinae; posterior margin of head with three spines, median coronals and a large medio-posterior.
armadillo (Redtenbacher)
 Head without paired elevated granulated carinae, at times with pluridentate post-orbital crests; posterior margin of head with paired spines but lacking a large medio-posterior 10
10. Supra-orbitals trituberculate, or with a more or less compound tubercle with low supplementary tubercles; pronotal anteriors absent; medio-longitudinal carina evident in mesonotal triangular area; posterior coxae without a spiniform process externally ... *deplanata* (Westwood)
 Supra-orbitals simple, spinose; pronotal anteriors low, tuberculate; medio-longitudinal carina not evident in mesonotal triangular area; posterior coxae with a distinct spiniform process externally.
spadix new species (in part)
11. Mesonotal triangular area distinctly surpassing middle of mesonotum; very slender and quite elongate *polillo* new species
 Mesonotal triangular area not surpassing middle of mesonotum; relatively short and quite stocky forms 12
12. Head with a pluridentate post-orbital crest; second abdominal segment with paired posteriors, these preceded by another pair on anterior

portion of disk, third to fifth tergites with first and second paired posteriors, sixth tergite with second paired posteriors.

cervicornis (Bolívar)

Head without post-orbital crests but with supra-orbital spinose tubercles; proximal abdominal segments with paired posteriors 13

13. Posterior coxae with a distinct spiniform production externally; metapleural bifid, spinose elements subequal; legs quite heavy distinctly incrassate *spadix* new species (in part)

Posterior coxae with a tuberculate production externally; metapleural bifid, ventral element relatively small; legs proportionately more slender and not distinctly incrassate 14

14. Disk of mesonotal triangular area smoothly and evenly concave; no indication of a medio-longitudinal carina in mesonotal triangular area *tagalog* new species

Disk of mesonotal triangular area weakly concave and distinctly verrucose; faint indications of the medio-longitudinal carina in the mesonotal triangular area *fratercula* new species

Draconina Group

The Draconina Group of the genus contains three closely related forms, *draconina* (Westwood) and the new species *hystrix* and *lachesis*. This group is characterized by having the body rather slender and elongate, the legs relatively elongate and varying from slender to moderately heavy. The mesonotal triangular area usually is longer than wide and in some forms is quite attenuate, its antero-lateral margins are always armed, either with a spinose tubercle or with a dentate crest. The inter-posterior mesonotals and the median metanotals are strong and spinose, the elements of each being partially fused at the base so that they appear as bifid spines. The lateral meso- and metapleurals are strongly spinose and the abdomen has some armature. The areolate area of the tibiae varies from subtruncate to moderately tuberculate. This group contains the extremely spiny members of the genus.

Hoplocloonia draconina (Westwood)

Plate 34, figs. 28 and 30.

1848. *Phasma* (*Pachymorpha*) *draconinum* Westwood, Cab. Orient. Entom., p. 78, pl. 38, fig. 5. 1 ♂, ♀; "Philippine Islands".]

1859. *Acanthoderus deplanatus* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 52.

1875. [*Tisamenus*] *draconinus* Stål,⁷⁶ Rec. Orth., III, p. 93.

1904. [*Tisamenus*] *draconinus* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Hoplocloonia draconina* Redtenbacher, Insektenfam. Phasm., I, p. 45, pl. I, fig. 9. 1 ♂, ♀; "Philippinen, Borneo".]

1915. *Hoplocloonia draconina* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 230.

This species, which is the most heavily armed member of the genus, may be separated from its closest relative by lacking a medio-posterior spine on the proximal abdominal tergite, although there is a low node or low

⁷⁶ In this work Stål refers Westwood's species to the genus *Tisamenus*, but does not form any combination with that specific name.

tubercle in this position. The mesonotal triangular area is attenuate, practically ending at the inter-posterior mesonotals as in *lachesis*. However, in the latter the antero-lateral angles are armed with a strong spinose tubercle, while in *draconina* this area is produced as a dentate crest with the largest element somewhat removed from the actual angle. Also the present species has only four mesonotal laterals, including the mesopleural that has migrated laterally, while the other members of this species group have five laterals. The metapleura has one lateral and a very large spinose supra-coxal, while the other members of the group usually have two lateral metapleurals and the supra-coxal is not as large. The posterior femora of *draconina*, particularly in the males, are relatively heavy.

Measurements.—The following extremes of measurements of the males examined, as well as those of the only adult female before us, are given to show the size variation in the species: length of body, males, 38.5-41 mm., female, 55; length of pronotum, males, 3-3.5, female, 4; length of mesonotum, males, 6-7.8, female, 10; length of metanotum, males, 3.5-3.8, female, 5; length of median segment, males, 2.5-2.6, female, 3; length of anterior femur, males, 8-8.2, female, 10.8; length of median femur, males, 7-7.8, female, 10.2; length of posterior femur, males, 9-9.6, female, 14.

Specimens examined.—8; 5 ♂, 1 ♀, 2 juv. ♀.

Luzon: Ripang,⁷⁷ Apayao Subprovince, Mountain Province; February, 1918; (W. Boettcher); 5 ♂, 1 ♀, 2 juv. ♀; [Hebard Cln.].

Hoploclonia hystrix new species

Plate 32, fig. 16.

This distinctive species is the only member of the *Draconina* Group to have the length of the mesonotal triangular area less than the width across the antero-lateral angles, moreover, this area does not extend posteriorly to the inter-posterior mesonotals, these and the median metanotals are subequal and spinose in the male and tuberculate in the female, while in *lachesis* the median metanotals are only about half the size of the inter-posterior mesonotals. The proximal abdominal segments of the male have the paired posteriors and the medio-posterior subequal, spinose tuberculate and the median segment has both of these elements but they are more tuberculate; in the female, of which we have only an immature individual before us, the medio-posterior is only about half the size of the paired posteriors, while in *draconina* the medio-posterior is not spinose and in *lachesis*, of which only the male is known, the medio-posterior is less than half as long as the paired posteriors and is distinctly tuberculate. In both the present species and in *lachesis* the antero-lateral angles of the triangular mesonotal area are terminated in spinose tubercles, and there are five mesonotal laterals.

Type.—♂; Sibulan, Oriental Negros, Negros, Philippines. (Baker.)
[United States National Museum.]

⁷⁷ See footnote 44.

Relatively short and quite slender, major elements of armature very prominent; legs rather slender and quite short.

Head rectangulate, slightly longer than broad; eyes rather prominent, globose; antennae with basal article flattened, more or less triquetrous, second article less than half as long, barrel-shaped, third article elongate, cylindrical, succeeding articles cylindrical, fourth and fifth quite short, following ones averaging longer distad; supra-orbitals strongly spinose, a pair of small spines mesad of these, median and lateral coronals low, tuberculate; surface of head with a few scattered nodes.

Pronotum subquadrate; triangular area delineated on disk, bounded anteriorly by paired bifid spinose tubercles, followed by low tuberculate elements, transverse sulcus rather prominent, dividing triangular area behind middle.

Mesonotum elongate, triangular area not reaching the middle, broader than long, antero-lateral angles armed with spinose tubercles, boundary of area granulate and with paired low tubercles near posterior apex, from area extends posteriorly a definite medio-longitudinal carina; inter-posteriors strongly spinose, bases connate. Mesopleura with five spinose laterals, anterior one (antero-lateral) smaller, posterior one equivalent to the laterally migrated supra-coxal. Mesosternum distinctly tricarinate, area between carinae relatively flat.

Metanotum a little longer than broad, a definite medio-longitudinal carina, medians spinose, subequal to inter-posterior mesonotals, bases connate. Metapleura with two laterals, normally spinose,⁷⁸ supra-coxal bifid, dorsal element much stronger, both spinose. Median segment with a medio-longitudinal carina, posterior mesal tuberculate, larger than paired posteriors. Metasternum with a definite medio-longitudinal carina.

Abdominal tergites subquadrate to slightly transverse, tergites 2 to 5 with spinose, subequal posterior mesal and paired posteriors, these tergites with a definite medio-longitudinal carina, sixth to ninth with indications of a carina and terminated in a low node or tubercle, that on ninth largest. Penultimate tergite with lateral margins in posterior half concave, posterior margin weakly concave, postero-lateral angles subnodose. Ultimate tergite broadly triangular, margin arcuate, apex obtuse-angulate. Poculum shallow, cup-shaped, with a slight marginal cingulation.

Anterior femora relatively short, all margins carinate, basal flexure rather prominent; dorso-posterior margin with spaced spinose tubercles to distal portion of flexure. Median and posterior femora with margins carinate, dorsal ones with spaced spinose tubercles in basal two-thirds.

General color dark vandyke brown with some portions as light as snuff brown; legs almost black.

Length of body, 35 mm.; length of pronotum, 3.2; length of mesonotum, 7.5; length of metanotum, 3.8; length of median segment, 2; length of anterior femur, 7; length of median femur, 6.5; length of posterior femur, 8.

Allotype.—Juv. ♀; Same data as type. [United States National Museum.]

⁷⁸ The dextral antero-lateral, which is evidently deformed, is represented by a low rounded tubercle.

Agreeing in all essential respects with the male except as follows: general surface not as smooth, with more scattered granules; paired spines mesad of supra-orbitals about as large as median and lateral coronals, all of which are slightly more spinose; antero-lateral angles of mesonotal triangular area with shorter spinose tubercles, inter-posterior mesonotals and median metanotals smaller, tuberculate; posterior mesal and paired posteriors of median segment subequal, tuberculate, those of tergites 2 to 5 with posterior mesal only about half as large as paired posteriors, abdominal tergites more transverse.⁷⁹

General color snuff brown with lateral portions of abdomen and legs vandyke brown.

Length of body, 40 mm.; length of pronotum, 3.8; length of mesonotum, 8.5; length of metanotum, 4; length of median segment, 2.3; length of anterior femur, 8.5; length of median femur, 7.5; length of posterior femur, 9.5.

We have also examined one immature male with the same data as the type, which agrees in all important features with the latter except that there is only one lateral metapleural. This specimen is also the property of the United States National Museum.

Hoplocionia lachesis new species

Plate 35, fig. 35.

This species combines some of the characters of *draconina* with some of those of *hystrix*, but has in addition a number in which it is distinctive. The mesonotal triangular area is elongate, tending to reach the inter-posterior mesonotals much as in *draconina*, while the antero-lateral angles of this area are armed with simple spinose tubercles, as in *hystrix*. The following characters are peculiar to the present form; posterior mesal of the basal abdominal segments shorter than the paired posteriors, the median segment has a row of rounded granules across the posterior margin, but has no definite armature. The inter-posterior mesonotals are rather strong, spinose tuberculate and are about twice as large as the median metanotals.

Type.—♂; Polillo Island, Philippines. (Taylor.) [United States National Museum.]

General form quite elongate and slender, armature quite prominent, legs elongate and slender, appearing less spiny than in related forms.

Head rectangular, a little longer than broad; eyes essentially as in *hystrix*; antennae with basal article triquetrous, second article cylindrical, about half as long as basal one, third article quite elongate cylindrical, remaining articles rather elongate cylindrical; supra-orbitals spinose, median and lateral coronals about half as large, spinose, between these and supra-orbitals is placed a transverse series of four tubercles with two other tubercles posterior of the mesal pair.

Pronotum subquadrate; triangular area faintly delineated, antero-lateral angles with strong bifid, spinose tubercles, branching at mid-point of their length, low rounded tubercles bounding rest of area, transverse sulcus slightly behind middle.

⁷⁹ As the specimen is immature it is not possible to give the characters of the apex of the abdomen.

Mesonotum elongate, rectangulate; triangular area elongate, definitely surpassing middle of notum, latero-anterior angles with a distinct spinose tubercle, boundary of rest of area rounded tuberculate to granulate; from posterior apex of area to inter-posteriors a definite subgranulate carina is present, inter-posteriors tuberculate, bases contiguous. Mesopleura with five spinose laterals, the first (antero-lateral) smaller and more distant from remainder, last lateral equivalent to laterally migrated mesopleural. Mesosternum tricarinate, lateral carinae subobsolete to obsolete anteriorly, area between carinae, where definite, relatively flat, anteriorly convex.

Metanotum elongate, rectangulate; medio-longitudinal carina definite, subgranular; medials low tuberculate, about half as long as inter-posterior mesonotals, bases of medials not definitely connate. Metapleura with two spinose laterals, supra-coxals distinctly spinose; supra-coxal angles tuberculate produced. Median segment transverse, median carina very faintly indicated; posterior margin with a transverse row of low granules. Metasternum with a faintly indicated medio-longitudinal carina.

Abdominal tergites subquadrate to slightly transverse; tergites 2 to 5 with spinose paired posteriors and a posterior mesal that varies from nodose to spinose but not more than half as long as posteriors, the latter progressively smaller posteriorly; faint indications of posteriors on tergites 6 and 7, these with a posterior mesal node, faint medio-longitudinal carina throughout abdomen; eighth and ninth tergites with carina more elevated posteriorly and there vertically declivous. Penultimate tergite with lateral margins in posterior two-fifths obliquely convergent, posterior margin weakly concave, postero-lateral angles subnodose. Ultimate tergite subtrapeziform, lateral margins obliquely convergent, posterior margin faintly convex. Poculum relatively deep, cup-shaped with a distinct marginal flange.

Anterior femora quite elongate and slender; basal flexure distinct in basal half, all margins carinate; dorso-posterior with spaced spinose tubercles in basal third. Median and posterior femora elongate and slender, dorsal margin with spaced low tubercles in basal fourth or third, these subobsolete to middle, thence lacking.

General color varying from warm sepia to burnt umber, venter lighter, almost clay colored.

Length of body, 51 mm.; length of pronotum, 3.5; length of mesonotum, 8.5; length of metanotum, 4; length of median segment, 2.5; length of anterior femur, 9; length of median femur, 8; length of posterior femur, 10.

This species is known only from the above described male.

Serratoria Group

The Serratoria Group contains four species, *serratoria* (Stål), *aspera* Bolivar and two new species. These all are characterized by the strong, spinose laterals of the meso- and metapleura, and the mesonotal triangular area extending to about the middle of the notum, this area either equilateral or slightly longer than broad. Most of the forms included in this group have post-orbital crests and the remaining member usually has composite supra-orbitals. The anterior pronotals are compound varying from bi- to quadridentate, the mesosternum is usually distinctly tricarinate. The most

stable and consistent element of the abdominal armature is the presence of paired posteriors. The areolate area of the tibiae in the forms included in the group varies from slightly produced to distinctly tuberculate.

Hoploclonia serratoria (Stål)

1875. *Tisamenus serratorius* Stål, Rec. Orth., III, p. 92. [♀; "Insulae Philippinae".]

1904. *T[isamenus] serratorius* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Tisamenus serratorius* Redtenbacher, Insektenfam. Phasm., I, pp. 43, 44. [♀; "Philippinen".]

1915. *Tisamenus serratorius* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 230.

This species is very closely related to *aspera* from which it may be distinguished by the bifid spinose metapleurals, as well as by the armature of the basal abdominal segments, on which are conical spinose paired posteriors.⁸⁰

We have no definite information as to the exact locality in the Philippines from which came this easily confused species.

Hoploclonia aspera (Bolívar)

1890. *Tisamenus asper* Bolívar, Ann. Soc. Españ. Hist. Nat., 19, p. 308. [♂, ♀; "Angat, (Filipinas)".]

1904. *T[isamenus] asper* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Tisamenus asper* Redtenbacher, Insektenfam. Phasm., I, pp. 43, 45.

1915. *Tisamenus asper* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 230.

This species, which has not been reported anew since its description, is very closely related to and hard to distinguish from *serratoria*. In *aspera* the mesopleural is spinose, and the basal abdominal segments have small rounded tubercles. Head with a post-orbital denticulate crest, the anterior tubercle of which is serrulate. Anterior pronotals tri- to quadridentate, above pronotal foramen a tubercle. Penultimate segment tuberculate, with curved serrate lateral carinae. Ultimate tergite small, obtuse-angulate. Ultimate sternite large, compressed, acuminate.

This species is known only from the original type locality, Angat, Bulacan Province, Luzon.

Hoploclonia clotho new species

Plate 34, fig. 29.

Typically this species is the most distinctive member of the *Serratoria* Group, as it lacks definite post-orbital crests, having in their place two or three spinose tubercles; however, some specimens have one or more of these compound and as a result closely resembling those members of the group which possess crests. This species may be separated from all the other forms except *atropos* by having not more than five spinose lateral mesonotals, and from *atropos* by having the posteriorly convergent arms

⁸⁰ In Stål's original description nothing is said about certain characters that later were stressed by Redtenbacher, and as the latter presumably had Stål's type (in the Bruner Collection) in front of him, the following, drawn from Redtenbacher, may be of some help; vertex with a pair of tubercles, and a posterior mesal on the abdominal segments.

of the triangular mesonotal area straight oblique instead of arcuate. The slightly shorter and proportionately heavier legs will also separate *clotho* from the closely related *atropos*.

Type.—♀; Polillo Island, Philippines. (Taylor.) [Hebard Collection, Type no. 1345.]

General form rather elongate and quite heavy, elements of armature rather prominent; legs relatively elongate and rather heavy.

Head almost quadrate, a little longer than broad: eyes globose, relatively prominent; antennae with basal article triquetrous, second article about half as long, subcylindrical, third article elongate, cylindrical, remaining articles cylindrical, averaging longer distad; supra-orbitals represented by three quite prominent, elongate tubercles, occipitals and median coronals lower, tuberculate, lateral coronals bifid, rounded tuberculate, scattered low rounded tubercles.

Pronotum subtrapeziform, triangular area faintly indicated behind transverse sulcus, which is median, bounded by subobsolete granules, anterior to sulcus by a trifid spinose tubercle.

Mesonotum elongate, triangular area attaining middle of notum, as long as wide, margins granulate, antero-lateral angles rounded tuberculate, a medio-longitudinal carina from apex of triangular area extending posteriorly, this carina faintly indicated in the triangular area. Mesopleura with four spinose laterals, the antero-lateral is small, subobsolete,⁸¹ last of spinose laterals representing laterally migrated mesopleural. Mesosternum weakly tricarinate, lateral carinae somewhat irregular, slightly mesad of these a few low rounded mesosternals.

Metanotum with a distinct medio-longitudinal carina. Metapleura with two spinose laterals, spinose supra-coxal, supra-coxal angle produced into a short tubercle, metapleural relatively small, tuberculate. Median segment with medio-longitudinal carina, posterior margin with a transverse series of low granules. Metasternum with very faint indication of a medio-longitudinal carina.

Abdominal tergites broadly transverse, with at least a trace of a medio-longitudinal carina, often indicated by low granules; tergites 2 to 5 with spinose second paired posteriors, with these elements indicated by low tubercles or nodes on remaining tergites, medio-posteriorly a node, progressively enlarging until it is a nodose tubercle on ninth tergite, with other elements, the paired and the first paired posteriors, often indicated by low nodes, tergites also with scattered low nodes or granules. Penultimate tergite, in lateral aspect, obliquely declivous, with a distinct medio-longitudinal carina, anteriorly on tergite a pair of low nodes, lateral margin in posterior half obliquely convergent, posterior margin weakly convex. Ultimate tergite convex with indication of a medio-longitudinal carina, lateral margins obliquely convergent, posterior weakly convex. Operculum relatively elongate, slightly surpassing ultimate tergite, navicular, carinate distally, apex rounded acute-angulate.

Legs essentially as in related forms except that they are proportionately heavier, this is especially true when compared with *atropos* with which the legs agree in armature.

⁸¹ The sinistral antero-lateral of the type is quite evident, but an examination of the remaining material indicates that it is normally greatly reduced.

General color buckthorn brown varying to darker on head and legs, venter somewhat lighter.

Length of body, 56 mm.; length of pronotum, 5.5; length of mesonotum, 10; length of metanotum, 5; length of median segment, 3.5; length of anterior femur, 11; length of median femur, 10; length of posterior femur, 13.

Allotype.—Juv. ♂; Same data as type. [United States National Museum.]

The male agrees in practically all features with the female described, with, however, the following differences noted: much less elongate, and much narrower; supra-orbitals with median element quite large, others small spinose, occipitals and median coronals stronger, gulars weakly indicated; anterior pronotals bifid, spinose; antero-lateral of metapleura quite small; abdominal tergites with only the second paired posteriors prominent, tergites with numerous low granules.⁸²

General color dark buffy brown.

The general body proportions are essentially the same as in the female, but we are not giving actual measurements as the specimen is not adult.

The only important variation noted in the specimens examined is that found in the supra-orbitals, which has been discussed above.

We have examined in addition to the type and allotype, one adult female, which we are considering a paratype, three immature females and one immature male, all from Polillo Island. With the exception of the type and the immature male in the Hebard Collection these belong to the United States National Museum.

Hoploclonia atropos new species

Plate 35, fig. 36.

This member of the *Serratoria* Group is quite close to *serratoria*, but is a less spiny form. It agrees with *draconina* and *aspera* in having supra-orbital crests, but is immediately separable from those species by having spinose metapleurals, but five lateral mesopleurals, and the bifid metapleural supra-coxal. The proximal abdominal tergites have the second paired posteriors, which are broadly tuberculate.

Type.—♀; Philippine Islands. 1932. [United States National Museum.]

General form rather elongate and rather heavy, armature except for lateral portions of thoracic pleura, insignificant; legs elongate and relatively slender.

Head subquadrate, slightly longer than broad; eyes as in related forms; antennae with basal article triquetrous, remainder lost; postorbital crest dentate, median element largest, occipital series indicated by low tubercles, between crests a pair of low tubercles, median and lateral coronals low tuberculate, one gular tubercle; general surface with a few scattered rounded granules or low tubercles.

⁸² As the specimen is immature it is useless to describe the apex of the abdomen.

Pronotum subtrapeziform; triangular area faintly delineated posteriorly by granules or low tubercles, anteriorly with a bi- or trifid crest, sulcus transverse, antero-lateral angle above foramen produced into a small tubercle.

Mesonotum elongate; elevated triangular area slightly surpassing middle of notum, lateral margins arcuately convergent, granulate, antero-lateral angles with rounded granules, anterior mesal mesonotals low rounded; medio-longitudinal carina distinctly granulate posteriorly from apex of triangular area, faintly discernible through triangular area. Mesopleura with five spinose laterals, the first one (antero-lateral) much smaller and more remote from others, posterior lateral equivalent to laterally migrated mesopleural. Mesosternum weakly but completely tricarinate.

Metanotum slightly transverse; medio-longitudinal carina granulate. Metapleura with two spinose laterals, supra-coxal bifid. Median segment with faint indications of a medio-longitudinal carina, paired posteriors represented by low rounded granules. Metasternum with median carina faintly indicated.

Abdominal tergites broadly transverse; tergites 2 to 5 with second paired posteriors broadly tuberculate, meso-posteriorly with a low node, sixth to ninth tergites with a full posterior series, some of the elements represented by very low granules, the meso-posterior node progressively more prominent posteriorly, that of ninth vertically declivous posteriorly. Penultimate tergite, in lateral aspect, obliquely declivous, meso-anteriorly with elongate, elliptical nodes, proximal two-thirds with a medio-longitudinal carina, lateral margins in posterior half obliquely convergent, very weakly concave, posterior margin truncate, weakly emarginate mesad. Ultimate tergite strongly convex, lateral margins obliquely convergent, posterior margin truncate. Opereculum elongate, slightly surpassing ultimate tergite, navicular, distinctly carinate in distal half, apex rounded acute-angulate.

Anterior femora relatively elongate and rather slender, basal flexure evident in basal three-fifths, all margins carinate, dorso-posterior with a few spaced spinose tubercles in basal two-thirds, dorso-anterior with a low serration beyond flexure. Median and posterior femora rather elongate and relatively slender, all margins rounded, dorsal ones near base with a few spaced spinose tubercles or serrations.

General color dark burnt umber, varying to vandyke brown on portions of head, pronotum and legs; venter vandyke brown.

Length of body, 54 mm.; length of pronotum, 5; length of mesonotum, 10.5; length of metanotum, 5; length of median segment, 3; length of anterior femur, 10.5; length of median femur, 9.5; length of posterior femur, 13.

Of this species, which unfortunately is known only from the "Philippine Islands", we have seen but the female type described above.

DEPLANATA GROUP

This species group contains six forms, three of these being new species and the others *cervicornis* Bolívar, *armadillo* Redtenbacher and *deplanata* of Westwood. The group members are all relatively plane and not heavily armed forms. The lateral thoracic margins are either denticulate or nodose, and except for the rather prominent supra-coxal spines which are present in

most of the forms, and the paired posteriors on the abdominal tergites, they are relatively smooth forms. The mesonotal triangular area is quite distinct and varies from slightly broader than long to slightly longer than broad. The medio-longitudinal carina is usually quite distinct throughout the greater part of the body. The distal margin of the areolate area of the tibiae varies from slightly produced to distinctly spinose.

Hoploclonia deplanata (Westwood)

Plate 35, fig. 34.

1847. *Phasma* (*Pachymorpha*) *deplanatum* Westwood, Cab. Orient. Ent., p. 78, pl. 38, fig. 6. [♀; "Philippine Islands".]

1859. *Acanthoderus deplanatus* Westwood, Cat. Orth. Ins. Brit. Mus., I, Phasm., p. 52.

1875. [*Tisamenus*] ⁸³ *deplanatus* Stål, Rec. Orth., III, p. 93.

1904. *T[isamenus] deplanatus* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Tisamenus deplanatus* Redtenbacher, Insektenfam. Phasm., I, pp. 43, 44.

1915. *Tisamenus deplanatus* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

This species is distinguished from most of the forms of this species group by having the mesonotal triangular area as broad as long or broader than long, usually subequilateral. The supra-orbitals are either compound (trituberculate) or with a large tubercle that may be more or less compound and with small supplementary tubercles.

The specimen of this species before us agrees in all important features with the original description and figure, and the following synopsis of its major features may be of some use to other workers: occipitals, median and lateral coronals relatively low, tuberculate; pronotum with anteriors usually bifid; mesonotum with triangular area elevated and with a faint trace of a medio-longitudinal carina, from the apex of this area to the apex of the abdomen this carina is quite strong; mesopleura with lateral margins faintly and irregularly granulate, supra-coxal angles rounded nodose; mesosternum tricarinate; metapleura with supra-coxal tuberculate, supra-coxal angle tuberculate; basal abdominal tergites with spinose second paired posteriors, general surface of these tergites with numerous scattered granules; apex of abdomen much as in *clotho* but with ultimate tergite distinctly broader; median and posterior femora with a few spaced spinose tubercles on dorso-posterior margin.

Specimens examined. — 1 ♀.

MINDANAO: Surigao; ⁸⁴ (Baker); 1 ♀; [U.S.N.M.].

Hoploclonia armadillo (Redtenbacher)

1906. *Tisamenus armadillo* Redtenbacher, Insektenfam. Phasm., I, pp. 43, 44, pl. I, fig. 8. [♀; "Philippinen".]

1915. *Tisamenus armadillo* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 230.

⁸³ Although Stål never actually made this combination, he definitely referred Westwood's species to his genus *Tisamenus*.

⁸⁴ It is not possible to say whether this specimen came from Surigao, Surigao Province or was picked up at some other point in that province.

This species is separable from the other members of the Deplanata Group by having elevated granulate post-orbital carinae and a medio-posterior spine on the head.

The following supplementary characters, drawn from Redtenbacher's description and figure, should be helpful in recognizing this form: in addition to the characters cited above the head has median coronal spines and numerous low tubercles; anterior pronotals compound, mesonotal triangular area a little broader than long, not attaining middle of notum, mesopleural margins serrulate, metapleura with a strong supra-coxal; basal abdominal tergites with spinose second paired posteriors, postero-lateral angle dentiform.

This species has not been noted since its description by Redtenbacher, and is not known from any definite locality in the Philippine Islands.

Hoploclo니아 cervicornis (Bolivar)

1890. *Tisamenus cervicornis* Bolivar, Ann. Soc. Españ. Hist. Nat., 19, p. 307, pl. I, figs. 5, 5a. [♂, ♀; "Camarines Sur (Filipinas)".]

1895. *Tisamenus cervicornis* Elera, Fauna Filipinas, II, p. 269.

1904. *T[isamenus] cervicornis* Kirby, Syn. Cat. Orth., I, p. 399.

1906. *Tisamenus cervicornis* Redtenbacher, Insektenfam. Phasm., I, pp. 43, 44.

1915. *Tisamenus cervicornis* Bruner, Univ. Nebr. Studies, XV, no. 2, p. 229.

The present species appears to be most closely related to *armadillo* (Redtenbacher) and *spadix*, here described. From all the other members of the group *cervicornis* differs by having pluridentate post-orbital crests with the second tooth largest, and the posterior margin has two lateral tubercles. The mesonotal triangular area is shallowly concave as in *spadix* and *tagalog*, and but very slightly longer than broad, not attaining the middle of the mesonotum. However, the armature of the abdomen is quite distinctive, the second tergite having paired second posterior tubercles, which are preceded by another pair of tubercles, third to fifth tergites with both first and second paired posterior tubercles, sixth tergite with tuberculate second posteriors.

Described from Camarines Sur, Luzon, this species is known only from the original material.

Hoploclo니아 spadix new species

Plate 31, fig. 9; pl. 32, fig. 18.

This species of the Deplanata Group is most closely related to *fratercula*, from which it differs, as well as from all the other members of the group, by having a distinct spiniform production externally on the posterior coxae. The mesonotal triangular area is broader than long (female) or longer than broad (male) and its disk is distinctly concave, more deeply so than in *tagalog*, the only other form in which this area is excised. The metapleural supra-coxal angle is produced into a bifid tubercle with the elements of equal strength, while in related forms the more dorsal element is larger. The legs, particularly of the male, are more distinctly incrassate than in

related forms. Moreover, the body, while about average in length, is proportionately broader than in the other members of the group.

Type.— δ ; Northwestern Panay, Philippines. (Baker.) [Hebard Collection, Type no. 1346.]

General form rather broad and about average in length for the members of the group; general surface with scattered granules; legs relatively short and quite heavy, distinctly incrassate.

Head rectangulate, a little longer than broad; eyes rather prominent, subglobose; antennae with basal article relatively long, triquetrous, second article rather short, barrel-shaped, third article relatively short, cylindrical, remaining articles relatively short, averaging somewhat longer distad; infra-orbitally with low carinae which end posteriorly in the rather strong, spinose supra-orbitals, occipitals, median and lateral coronals low tuberculate, gulars weakly indicated, meso-posterior to supra-orbitals a pair of low tubercles; general surface with scattered granules.

Pronotum subquadrate; triangular area bounded by low carinae, anteriors bifid, spinose tuberculate, between anteriors a pair of very low rounded tubercles, sulcus transverse slightly behind the middle, angle above pronotal foramen produced into a short node.

Mesonotum elongate; mesonotal triangular area slightly longer than broad, attaining middle of mesonotum, disk concave, area bounded by sparsely granulate carinae, antero-lateral angles produced into low rounded tubercles, from posterior apex of this area a medio-longitudinal carina extends posteriorly. Mesopleura with lateral represented by four or five low lateral granulations, a single spinose tuberculate supra-coxal. Mesosternum distinctly tricarinate, areas between carinae more or less flattened.

Metanotum with a distinct medio-longitudinal carina. Metapleura with two pairs of lateral granulations, supra-coxal bifid, spinose tuberculate, elements subequal. Median segment and metasternum both with a medio-longitudinal carina.

Abdominal tergites transverse, a definite medio-longitudinal carina; tergites 2 to 4 with spinose tuberculate second paired posteriors, general surface of tergites with scattered low granules and a few scattered transverse rugae, and with a narrow lateral flange. Penultimate tergite with lateral margins in posterior two-fifths weakly concave, posterior margin very weakly and broadly concave, postero-lateral angles subnodose. Ultimate tergite broadly trapeziform, posterior margin subtruncate. Poculum cup-shaped, rather deep, with a distinct posterior and postero-lateral lip.

Anterior femora relatively short, rather heavy, basal flexure evident in basal three-fourths, all margins at least weakly carinate, dorso-posterior with spaced serrations, ventral margins beyond flexure with spaced serrations. Median femora quite short, distinctly incrassate, all margins carinate, armed with spaced serrations, those on ventral margins stronger. Posterior coxae with a prominent spiniform process externally. Posterior femora quite short and distinctly incrassate, all margins carinate and armed with spaced serrations.

General color of dorsum and legs rich chocolate brown, with apex of abdomen somewhat darker, venter walnut brown.

Length of body, 37 mm.; length of pronotum, 3.8; length of mesonotum, 8.2; length of metanotum, 4.2; length of median segment, 2.3; length of anterior femur, 7.5; length of median femur, 7; length of posterior femur, 8.

Allotype. — ♀; Culasi, Antique Province, Panay, Philippines. May 24, 1918. (R. C. McGregor.) [Academy of Natural Sciences of Philadelphia.]

General form and structure essentially as in male except as follows: more elongate and proportionately broader; head with elements essentially as in male but more prominent, due to the lack of numerous small granules; pronotum with margins of elevated area more granulate; mesonotum with triangular area broader than long, not attaining middle of notum, its margin granulate; mesopleura with laterals slightly more prominent; metapleura with laterals more prominent and with a low tuberculate metapleural; medio-longitudinal carina of metasternum not as prominent; abdominal tergites more broadly transverse, their posterior margins with a series of transverse nodes, a postero-mesal node on tergites 2 to 6, carina of seventh to ninth tergites elevated posteriorly and at posterior margin vertically declivous; penultimate tergite much like that of the male but postero-lateral angles not definitely nodose; ultimate tergite longer than broad, lateral margins obliquely convergent posteriorly, posterior margin convex, weakly obtuse-angulate; operculum relatively elongate, not surpassing ultimate tergite, linear, carinate in apical two-thirds, apex angulate; legs essentially as in male except that they are not distinctly incrassate and the anterior ones have a serration on dorso-anterior margin beyond basal flexure.

General color buffy brown with anteriors of pronotum and spines of legs varying to natal brown; abdominal posteriors blackish; venter clay colored.

Length of body, 49 mm.; length of pronotum, 4.5; length of mesonotum, 9; length of metanotum, 4.3; length of median segment, 3; length of anterior femur, 9.2; length of median femur, 8.2; length of posterior femur, 10.5.

Specimens examined. — 4; 1 ♂, 1 ♀, 1 juv. ♂, 1 juv. ♀.

PANAY: Northwestern part; (Baker), 1 ♂ (type); [Hebard Cln.]. Culasi, Antique Prov.; May 18-24, 1918; (R. C. McGregor); 1 ♀ (allotype), 1 juv. ♂, 1 juv. ♀; [A.N.S.P.].

Hoploclonia tagalog new species

Plate 32, fig. 17.

The present species is closely related to both *spadix* and *fratercula*, and shares with the former the slightly concave disk of the mesonotal triangular area, without any indications of a medio-longitudinal carina; but is distinct from either of these forms by having the posteriorly convergent arms of the area weakly arcuate. In common with *fratercula* this form lacks a definite spiniform process on the posterior coxae, and has the metapleural supra-coxal bifid with the more ventral element much smaller. The femora are more slender than in either of these related forms.

Type. — ♂; Aroroy, Masbate, Philippines. August 8, 1912. (W. Boettcher.) [Hebard Collection, Type no. 1347.]

General form rather slender and elongate; legs rather heavy but not incrassate.

Head subquadrate; eyes globose, relatively prominent; antennae with basal article triquetrous, second article relatively short, barrel-shaped, third article longer, subcylindrical, third and fourth articles quite short submoniliform, remaining articles short cylindrical, averaging longer distad; supra-orbitals rather prominent spinose, occipitals, median and lateral coronals low rounded tuberculate.

Pronotum subquadrate; triangular area weakly indicated, lateral margins posteriorly subgranulate, antero-lateral angles armed with a bifid spinose tubercle; antero-lateral angles above foramen rounded, lobate.

Mesonotum with triangular area faintly longer than broad, posteriorly convergent arms weakly arcuate, antero-lateral angles low, rounded tuberculate, disk shallowly concave; medio-longitudinal carina from triangular area posteriorly. Mesopleura with laterals represented by low rounded tubercles, supra-coxals simple, spinose. Mesosternum tricarinate, lateral carinae weaker.

Metanotum with a medio-longitudinal carina. Metapleura with laterals weak, low rounded tuberculate, supra-coxal bifid, dorsal element spinose tuberculate, ventral element tuberculate, very faint indications of a tuberculate metapleural. Median segment carinate. Metasternum very weakly carinate.

Abdominal tergites transverse; 2 to 4 with tuberculate paired second posteriors, a medio-longitudinal carina throughout abdomen, a posterior mesal node on tergites 2 to 7, eighth and ninth with carina elevated posteriorly and vertically declivous at posterior margin; general surface of tergites with scattered granules. Penultimate tergite with lateral margin weakly concave in posterior half, posterior margin almost subtruncate, emarginate mesad. Ultimate tergite distinctly trigonal, apex obtuse-angulate. Poculum shallowly cup-shaped with a wide flange around free margin.

Legs essentially as in *fratercula*, but somewhat more slender, all femora not distinctly carinate and with a few spaced serrations on dorso-anterior margin of anterior femora beyond basal flexure. Median and posterior femora with dorso-anterior margin relatively smooth.

General color very dark chocolate brown, varying to tawny on venter.

Length of body, 37.8 mm.; length of pronotum, 4; length of mesonotum, 8.2; length of metanotum, 4; length of median segment, 2.5; length of anterior femur, 7; length of median femur, 7; length of posterior femur, 8.6.

This interesting form from the Island of Masbate is known only from the type.

Hoplocloonia fratercula new species

Plate 31, fig. 5.

This species, another of the Deplanata Group, is closely related to *tagalog* from which it may be separated by its slightly shorter body, and the somewhat narrower mesonotal triangular area, which has its surface verrucose and with a slight indication of a medio-longitudinal carina, instead of having this area broader, its surface weakly concave and without any indications of a medio-longitudinal carina. The abdominal paired posteriors are more or less spinose in *fratercula* and tuberculate in *tagalog*, also the penultimate tergite of the former has the posterior margin weakly

concave and the ultimate tergite relatively broad, half elliptical, instead of having the posterior margin emarginate and the ultimate tergite distinctly trigonal.

Type. — ♂; Butucan, Tayabas Province, Luzon. October 4, 1916. (W. Boettcher.) [Hebard Collection, Type no. 1253.]

General form relatively slender and rather short; legs quite heavy.

Head subquadrate; eyes globose; antennae with basal article triquetrous, second article shorter, barrel-shaped, remaining articles lost; supra-orbitals spinose, occipitals, median and lateral coronals low, rounded tuberculate.

Pronotum weakly subtrapeziform; triangular area very weakly indicated, anteriors bifid, spinose, sulcus transverse slightly behind middle of notum, antero-lateral angles above foramen produced into an obtuse-angulate flap.

Mesonotum somewhat elongate, mesonotal triangular area distinctly longer than wide, margins carinate, disk verrucose, with very faint indications of a medio-longitudinal carina, the whole area on a feebly indicated triangular base;⁸⁵ from apex of triangular area a posteriorly directed medio-longitudinal carina. Mesopleura with laterals indicated by indistinct low tubercles; supra-coxal spinose. Mesosternum tricarinate.

Metanotum with a medio-longitudinal carina. Metapleura with laterals faintly indicated by low rounded tubercles, supra-coxal bifid, dorsal element spinose, ventral smaller, broadly tuberculate. Median segment with a medio-longitudinal carina. Metasternum weakly carinate.

Abdominal tergites transverse; tergites 2 to 4 with spinose, second paired posterior tubercles, these weakly indicated by low tuberculate nodes on fifth tergite, a medio-longitudinal carina evident throughout abdomen, on apical tergites tending to end in a low node; general surface of tergites often with scattered granules along posterior margin. Penultimate tergite with lateral margins weakly concave in posterior half, posterior margin weakly concave. Ultimate tergite half elliptical. Poculum cup-shaped with a posterior and postero-lateral flange, very weakly emarginate meso-posteriorly.

Anterior femora relatively short and only moderately heavy, basal flexure evident in basal three-fourths; all margins at least weakly carinate, dorso-posterior in basal three-fourths with spaced low serrations, ventral margins at distal end of flexure with a low tooth. Median femora relatively short and quite heavy, margins weakly carinate, ventral ones with spaced serrations, dorso-anterior with low spaced nodes. Posterior femora a little longer and quite heavy, margins weakly carinate, ventral ones and dorso-posterior with spaced serrations, dorso-anterior with low nodes.

General color dark chocolate brown, venter lighter.

Length of body, 35 mm.; length of pronotum, 4; length of mesonotum, 7.5; length of metanotum, 4; length of median segment, 2; length of anterior femur, 7.8; length of median femur, 7; length of posterior femur, 8.8.

This species from the Province of Tayabas is known only from the male here described.

⁸⁵ In the other forms of the genus the lateral portions of the mesonotum are gradually inclined upward to the margins of the mesonotal triangular area, but in *fratercula* the mesonotum is more or less flat, and upon reaching the basal triangular area there is a distinct angulation and the true mesonotal triangular area rests upon this basal area.

POLILLO GROUP

The Polillo Species Group, which contains only the nominate form, exhibits a combination of the characters found in the Deplanata Group and those of the Draconina Group, as well as certain distinctive characters of its own. The lack of spinose laterals on the thorax is a characteristic shared with the Deplanata Group, while the general elongate and relatively slender form, as well as the elongate mesonotal triangular area are also features in common with the latter group. However, the general lack of strong armature except for the anterior pronotals and supra-coxals, the rather heavy legs and the faintly indicated medio-longitudinal carina of the abdomen will further distinguish this group from those compared. The areolate area of the tibiae varies from slightly produced to subspinose.

Hoplocloonia polillo new species

Plate 31, fig. 6.

This very distinctive species is discussed above under the group summary. The only strong lateral elements of the thorax are the laterally migrated supra-coxals of the meso- and metapleura, as is the case in the members of the Deplanata Group, while the elongate and slender form as well as the elongated mesonotal triangular area suggests the forms of the Draconina Group. The general lack of armature, combined with the body form, are distinctive of this species.

Type. — ♂; Polillo Island, Philippines. (Taylor.) [Hebard Collection, Type no. 1254.]

General form elongate and slender; except for the few major elements of armature which are spinose or tuberculate, the general surface is more or less granulose and the legs are relatively short.

Head rectangulate, longer than wide; eyes quite prominent, globose; antennae with basal article rather short, triquetrous, second article a little more than half as long, barrel-shaped, third article rather elongate, subcylindrical, remaining articles relatively short, cylindrical, averaging slightly longer distad; supra-orbitals large, simple, spinose; occipitals, median and lateral coronals represented by low rounded tubercles.

Pronotum subquadrate, triangular area weakly indicated behind the transverse sulcus, anterior trituberculate with anterior element largest, a pair of low rounded tubercles near posterior margin.

Mesonotum elongate rectangulate, mesonotal triangular area shallowly concave and verrucose, rather elongate, distinctly longer than wide and distinctly surpassing middle of notum, antero-lateral angles produced into tubercles, from apex of this area is a posteriorly directed medio-longitudinal carina. Mesopleura with five laterals, including antero-lateral, represented by very low rounded tubercles, supra-coxal rather strong, spinose tuberculate. Mesosternum tricarinate, medio-longitudinal definite but laterals subobsolete, practically absent anteriorly.

Metanotum with a definite medio-longitudinal carina, a low posterior mesal node. Metapleura with two laterals indicated by very low rounded tubercles, supra-coxal relatively strong, spinose tuberculate, metapleural faintly indicated by a very low tubercle. Median segment with a faintly

indicated medio-longitudinal carina, with a transverse row of low granules. Metasternum with a distinct medio-longitudinal carina.

Abdominal tergites subquadrate to slightly transverse; abdominal tergites with second paired posteriors faintly indicated by very low tubercles or nodes, a very faint indication of a medio-longitudinal carina, tergites with numerous scattered granules; ninth and tenth tergites with a more or less distinct medio-longitudinal carina on posterior half, terminating in a distinct node. Penultimate tergite with lateral margins in posterior third deeply concave, posterior margin broadly and evenly concave; postero-lateral angles decidedly produced into relatively prominent nodes. Ultimate tergite subtrapeziform, posterior margin weakly convex. Poculum cup-shaped, relatively deep, postero-lateral angles produced into laminate flanges, their margins distinctly cingulate, cup-shaped portion terminated in a low node.

Anterior femora relatively short, basal flexure evident for three-fifths their length, margins carinate, dorso-posterior in basal half with two or three spaced spinose tubercles. Median femora relatively short and rather heavy, margins weakly carinate, dorsal margins in basal half with a few spaced serrations or tubercles, ventral margins in distal half with spaced serrations. Posterior femora somewhat longer than median one and about as heavy, margins weakly carinate, dorsal margin in basal three-fifths with spaced serrations or tubercles, ventral margins with spaced serrations.

General color of body and legs bone brown, medio-longitudinal carina army brown, venter varying to army brown.

Length of body, 36 mm.; length of pronotum, 3.2; length of mesonotum, 7.5; length of metanotum, 3.8; length of median segment, 2; length of anterior femur, 8; length of median femur, 7.5; length of posterior femur, 9.

This distinctive species is known only from the above described male.

EXTRA-LIMITAL GENERA OF THE TRIBE DATAMINI OF THE OBRIMINAE

PLANISPECTRUM new genus

1906. *Platymorpha* Redtenbacher (nec Jacoby),⁸⁷ Insektenfam. Phasm., I, p. 46, pl. 1, fig. 12.

Genotype. — *Platymorpha cochinchinensis* Redtenbacher [= *Planispectrum cochinchinensis* (Redtenbacher)], ("Cochinchina"). By present designation.

ORESTES Redtenbacher

1906. *Orestes* Redtenbacher, Insektenfam. Phasm., I, p. 47, pl. 1, fig. 12.

Genotype. — *Orestes verruculatus* Redtenbacher, ("Siam, Bangkok"). By monotypy.

PYLAEMENES Stål

1875. *Pylaemenes* Stål, Rec. Orth., III, pp. 51, 93.

1904. *Pylaemenes* Kirby, Syn. Cat. Orth., I, p. 400.

1906. *Pylaemenes* Redtenbacher, Insektenfam. Phasm., I, p. 47, pl. 1, figs. 13, 14.

Genotype. — *P[hasma]* (*Pachymorpha*) *coronatum* Haan [= *Pylaemenes coronatus* (Haan)], ("Java, Amboina, Borneo"). By designation of Kirby, 1904.

⁸⁷ *Platymorpha* Jacoby, Biol. Centr.-Amer., Col., VI, (1), p. 602, (1888).

DATAMES Stål

1875. *Datames* Stål, Rec. Orth., III, pp. 51, 93.

1904. *Datames* Rehn, Proc. Acad. Nat. Sci. Phila., LVI, p. 89.

1904. *Datames* Kirby, Syn. Cat. Orth., I, p. 400.

1906. *Datames* Redtenbacher, Insektenfam. Phasm., I, p. 49, pl. 1, figs. 15, 16.

Genotype. — *Acanthoderus oleus* Westwood [= *Datames oleus* (Westwood)], ("Insula Java"). By designation of Rehn, 1904.

DARES Stål

1875. *Dares* Stål, Rec. Orth., III, pp. 51, 93.

1904. *Dares* Kirby, Syn. Cat. Orth., I, p. 400.

1906. *Dares* Redtenbacher, Insektenfam. Phasm., I, p. 53, pl. 1, figs. 17, 18.

Genotype. — *D[ares] validispinus* Stål, ("Borneo"). By designation of Kirby, 1904.

WOODLARKIA Günther

1932. *Woodlarkia* Günther, Mitt. Zool. Mus. Berlin, 17, p. 754.

Genotype. — *Karabidion scorpionides* Montrouzier [= *Woodlarkia scorpionides* (Montrouzier)], ("Woodlark Island"). By original designation.

EXPLANATION OF PLATES 31 TO 38

PLATE 31.

- Fig. 1.—*Eubulides taylora* new species. Lateral view of apex of abdomen of female (type). Polillo Island. (Greatly enlarged.)
- Fig. 2.—*Eubulides taylora* new species. Dorsal view of eighth and ninth tergites of female (type). Polillo Island. (Greatly enlarged.)
- Fig. 3.—*Illocano hebardei* new genus and species. Dorsal view of female (type). Baguio, Benguet, Luzon. ($\times 1\frac{1}{2}$.)
- Fig. 4.—*Eubulides igorrota* new species. Dorsal view of head, pro- and mesonotum of male (type). Imugan, Nueva Vizcaya, Luzon. ($\times 2$.)
- Fig. 5.—*Hoplocloonia fratercula* new species. Dorsal view of head, pro- and mesonotum of male (type). Butuan, Tayabas, Luzon. ($\times 2$.)
- Fig. 6.—*Hoplocloonia polillo* new species. Dorsal view of head, pro- and mesonotum of male (type). Polillo Island. ($\times 2$.)
- Fig. 7.—*Obrimus uichancoi* new species. Portion of metasternum of female (type). Ripang, Luzon. (Greatly enlarged.)
- Fig. 8.—*Euobrimus cavernosus* (Stål). Dorsal view of male. Siargao Island. ($\times 1$.)
- Fig. 9.—*Hoplocloonia spadix* new species. Dorsal view of head, pro- and mesonotum of female (type). Culasi, Panay. ($\times 2$.)
- Fig. 10.—*Eubulides taylora* new species. Lateral view of apex of abdomen of male (allotype). Polillo Island. (Greatly enlarged.)
- Fig. 11.—*Stenobrimus tagalog* new species. Lateral view of apex of abdomen of male (type). Polillo Island. (Greatly enlarged.)
- Fig. 12.—*Brasidas viscayanus* new genus and species. Dorsal view of female (type). Butuan, Mindanao. ($\times 1$.)

PLATE 32.

- Fig. 13.—*Aretaon (Trachyaretaon) echinatus* (Stål). Dorsal view of female. Sibuyan Island. ($\times 1\frac{1}{2}$.)
- Fig. 14.—*Obrimus uichancoi* new species. Dorsal view of female (type). Ripang, Luzon. ($\times 1\frac{1}{2}$.)

- Fig. 15.—*Obrimus bicolanus* new species. Dorsal view of female (type). Bulusan, Sorsogon, Luzon. ($\times 1\frac{1}{2}$.)
 Fig. 16.—*Hoplocloonia hystrix* new species. Dorsal view of male (type). Sibuyan Island. ($\times 1\frac{1}{2}$.)
 Fig. 17.—*Hoplocloonia tagalog* new species. Dorsal view of male (type). Aroroy, Masbate. ($\times 1\frac{1}{2}$.)
 Fig. 18.—*Hoplocloonia spadix* new species. Dorsal view of male (allotype). Northwestern Panay. ($\times 1\frac{1}{2}$.)

PLATE 33.

- Fig. 19.—*Brasidas montivagus* new genus and species. Dorsal view of male (type). Mount Galintan, Davao, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 20.—*Brasidas montivagus* new genus and species. Dorsal view of female (allotype). Mati, Davao, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 21.—*Euobrimus cleggi* new genus and species. Dorsal view of male (type). Libulan River, Mount Apo, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 22.—*Euobrimus atherura* new genus and species. Dorsal view of male (type). Baroring River, Mount Apo, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 23.—*Brasidas quadratipes* (Bolivar). Dorsal view of male. Siargao Island. ($\times 1\frac{1}{2}$.)
 Fig. 24.—*Brasidas acanthoderus* new genus and species. Dorsal view of female (type). Davao, Mindanao. ($\times 1\frac{1}{2}$.)

PLATE 34.

- Fig. 25.—*Brasidas foveolatus foveolatus* (Redtenbacher). Dorsal view of male. Tanglecolan, Bukidnon, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 26.—*Brasidas foveolatus asper* new subspecies. Dorsal view of male (type). Davao, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 27.—*Brasidas viscayanus* new species. Dorsal view of male (allotype). Butuan, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 28.—*Hoplocloonia draconina* (Westwood). Dorsal view of female. Ripang, Luzon. ($\times 1\frac{1}{2}$.)
 Fig. 29.—*Hoplocloonia clotho* new species. Dorsal view of female (type). Polillo Island. ($\times 1\frac{1}{2}$.)
 Fig. 30.—*Hoplocloonia draconina* (Westwood). Dorsal view of male. Ripang, Luzon. ($\times 1\frac{1}{2}$.)

PLATE 35.

- Fig. 31.—*Euobrimus atherura* new genus and species. Dorsal view of female (allotype). Calian, Davao Province, Mindanao. ($\times 1\frac{1}{2}$.)
 Fig. 32.—*Euobrimus bakeri* new genus and species. Dorsal view of male (type). Samar. ($\times 1\frac{1}{2}$.)
 Fig. 33.—*Brasidas samarensis* new genus and species. Dorsal view of male (type). Samar. ($\times 1\frac{1}{2}$.)
 Fig. 34.—*Hoplocloonia deplanata* (Westwood). Dorsal view of female. Surigao, Mindanao. ($\times 1\frac{1}{2}$.)
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PLATE 36.

- Fig. 37.—*Brasidas samarensis* new genus and species. Dorsal view of female (paratype). Samar. ($\times 1\frac{1}{2}$.)
 Fig. 38.—*Euobrimus cavernosus* (Stål). Dorsal view of female. Siargao Island. ($\times 1\frac{1}{2}$.)

PLATE 37.

- Fig. 39.—*Euobrimus bakeri* new genus and species. Dorsal view of female (allotype). Samar. ($\times 1\frac{1}{2}$.)
 Fig. 40.—*Euobrimus cleggi* new genus and species. Dorsal view of female (allotype). Libulan River, Mount Apo, Mindanao. ($\times 1\frac{1}{2}$.)

PLATE 38.

- Fig. 41.—*Obrimus bicolanus* new species. Dorsal view of head, pro- and mesonotum of female (type). Bulusan, Sorsogon, Luzon. (Greatly enlarged.)
- Fig. 42.—*Obrimus uichancoi* new species. Dorsal view of pro- and mesonotum of female (type). Ripang, Luzon. (Greatly enlarged.)
- Fig. 43.—*Brasidas quadratipes* (Bolivar). Ventral view of metasternum of male. Siargao Island. (Greatly enlarged.)
- Fig. 44.—*Euobrimus cavernosus* (Stål). Ventral view of metasternum of female. Siargao Island. (Greatly enlarged.)
- Fig. 45.—*Brasidas viscayanus* new genus and species. Ventral view of metasternum of female (type). Butuan, Mindanao. (Greatly enlarged.)
- Fig. 46.—*Stenobrimus tagalog* new species. Dorsal view of male (type). Polillo Island. ($\times 1\frac{1}{2}$.)
- Fig. 47.—*Mearnsiana bullosa* new genus and species. Dorsal view of male (type). Mount Apo, Mindanao. ($\times 1\frac{1}{2}$.)

ABSTRACTS OF MINUTES OF THE PROCEEDINGS OF
THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

FEBRUARY 15, 1938

Annual Meeting of the Academy.

Twenty-nine members present.

President, Charles M. B. Cadwalader, in the Chair.

Annual reports covering the year 1937 were presented by the President and the Treasurer.

New members were reported as follows:

Associate Sustaining Members (1)

Mrs. John Penn Brock.

Life Members (10)

Ambrose C. Cramer, III, George M. Cheston, Harrison Hires, A. Atwater Kent, Jr., George Murnane, Jr., Miss Augustine Pardee Shaw, Miss Marjorie Pemberton Shaw, Mrs. Francis J. Stokes, Robert R. Solenberger and Robert Toland, Jr.

Contributing Members (4)

Mrs. Emory McMichael, J. Kearsley Mitchell, Cuthbert Parrish and Mrs. Cuthbert Parrish.

Annual Members (67)

The Baldwin School, Lewin B. Barringer, John C. Bell, Jr., Mrs. H. Bartol Brazier, Miss Eleanor O. Brownell, Edward G. Budd, George T. Butler, Charles Chaplin, Mrs. George B. Clothier, John S. Conger, Sydney Connor, Jay Cooke, C. Joseph Dexter, Mrs. James Mapes Dodge, Dr. Frederick Ehrenfeld, Mrs. Chancellor C. English, Allison F. Fleitas, Richard W. Foster, Edward J. Galbally, Henry E. Gerstley, John A. Harris, Jr., Miss Margaret Harrison, Harry G. Haskell, Morris Jones, Mrs. Moorhead C. Kennedy, Dr. I. M. Koch, Mrs. B. H. Brewster Koons, William Fulton Kurtz, Mrs. William Colin Lee, Miss Anne S. Lewis, Dr. Daniel J. McCarthy, James McMullan, Mrs. James McMullan, William J. Martin, Mrs. David Milne, Miss Mary Binney Montgomery, Harvey Moore, Mrs. Daniel J. Murphy, Herbert B. Nichols, Miss Olive Pardee, Mrs. Joseph N. Pew, W. W. Philler, E. Curzon Poultney, Caleb S. Ridgway, Jr., Miss Ruth Ritchie, Miss Lydia S. M. Robinson, Samuel Robinson, Jerome J. Rothschild, Pedro G. Salom, Mrs. F. R. Schwengel, Thomas M. Scott, Joseph G. Shryock, William Simpson, Joseph N. Snellenburg, P. C. Staples, John J. Sullivan, Henderson Supplee, Jr., Miss Olga E. Tafel, Dr. E. Winslow Taylor, Mrs. Sydney Thayer, Giles Price Wetherill, Mrs. Giles Price Wetherill, Joseph E. Widener, Lawrence N. Wight, Mrs. Ellis T. Williams, S. Davis Wilson, Mrs. Alan Dewees Wood.

Junior Members (42)

Donald G. Barnhouse, Jr., Fernand Baruch, Jr., Glenn W. Bricker, John C. Bullitt, William Burke, William Walsh Carroll, Charles Edward Childs, Jr., Richard C. Christopher, Charles Clement, Andrew Jackson Culver, Jr., Peter Dechert, Nelson Degerberg, Robert Degerberg, James Deubler, Bob Doak, Frederick R. Drayton, Jr., Benjamin V. Goodwin, Robert L. Haines, John H. Hill, Thomas M. Hopkins, C. Craig Huff, Jr., George M. Keiser, Charles Lancaster Leedom, Robert Lockwood, Frank I. Loughran, George L. Morrison, Jr., James H. Parcher, Benjamin Perkins, John Douglas Perkins, III, John N. Pomeroy, Herdman Porter, Peter Randall, Howard Scott, J. K. Lee Smith, Jr., Alan Bell Stewart, Harry G. Roland, Bertram A. Tunnell, Jr., John W. Tunnell, Edward Z. Wallower, H. Caner Wiederseim, Howard Page Wood and William Jenks Wright, Jr.

Deaths of the following members were announced: Mrs. W. W. Atterbury, Francis B. Braeken, Frederick W. Brill, Robert G. Bursk, Mrs. John Cadwalader, Mrs. David S. B. Chew, Adolph Christensen, Edward Walter Clark, John Diekey, Jr., Clarence W. Dolan, Dr. Henry S. Drinker, Howard S. Eckels, William Struthers Ellis, Thomas Langdon Elwyn, Edgar C. Felton, Stephen Fuguet, James Gay Gordon, Dr. Milton J. Greenman, J. B. Hamilton, Dr. Charles H. LaWall, H. M. League, Mrs. John Frederick Lewis, Mrs. John Markoe, Mrs. Arthur V. Meigs, Mrs. David Milne, John S. Newbold, George L. Pennock, Fred A. Rakestraw, Henry W. Roth, Mrs. Samuel R. Shipley, Lorraine S. Tahl, Mrs. Alan Wilson, and Frederick C. Young.

Following their nomination as prescribed by the By-Laws of the Academy the following individuals were elected members of the Board of Trustees for the period extending to the Annual Meeting of 1941: Cary W. Bok, Edwin G. Conklin, Edgar B. Howard, E. R. Fenimore Johnson, Morris L. Parrish, Arthur E. Newbold, Jr., George D. Widener.

OFFICERS ELECTED

At a meeting of the Board of Trustees of the Academy, held April 11, 1938, the following officers were elected:

President: Charles M. B. Cadwalader

Vice-Presidents: Witmer Stone

Edwin G. Conklin

Managing Director: Charles M. B. Cadwalader

Treasurer: Arthur E. Newbold, Jr.

Assistant Treasurer: John E. Bowers

Secretary: John E. Bowers

Corresponding Secretary: James A. G. Rehn

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REHN: A REVISION OF NEOTROPICAL EUTHYMIÆ



PENNELL: WHAT IS COMMELINA COMMUNIS?



A



B

BOND AND DE SCHAUENSEE: ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SOUTH PACIFIC
EXPEDITION OF 1937. PART II, — THE BIRDS OF MALPELO ISLAND, COLOMBIA



A



B

BOND AND DE SCHAUENSEE: ZOOLOGICAL RESULTS OF THE
GEORGE VANDERBILT SOUTH PACIFIC EXPEDITION OF 1937.
PART II, — THE BIRDS OF MALPELO ISLAND, COLOMBIA



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Block diagram of the MINYA KONKA (24,900') and VICINITY in Chinese Tibet by A. B. Emmons III.



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DOLAN: ZOOLOGICAL RESULTS OF THE SECOND DOLAN EXPEDITION TO WESTERN CHINA AND EASTERN TIBET, 1934-1936. PART I.—INTRODUCTION



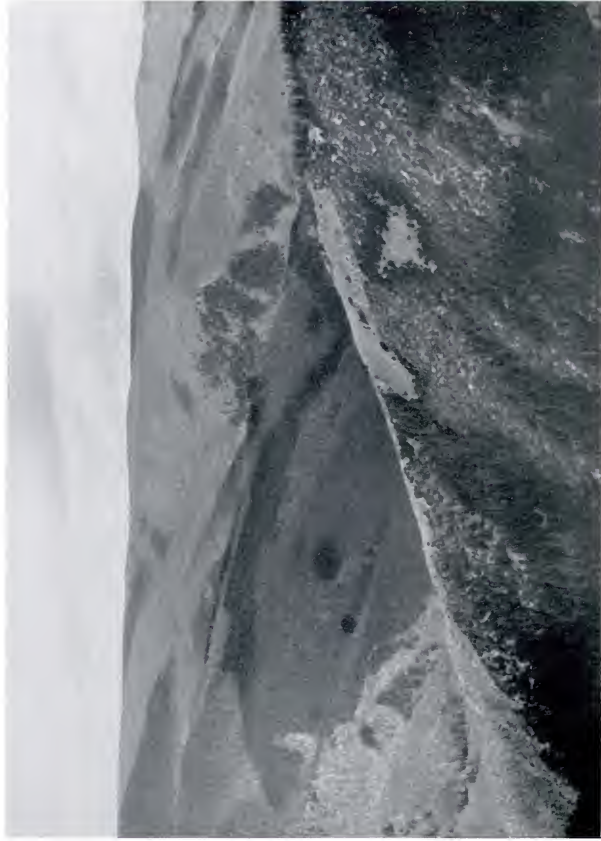
KHAM FOREST: MIXED DECIDUOUS AND CONIFEROUS FOREST, BETWEEN CAMPS 5 AND 6, ELEVATION 12,500 FEET.

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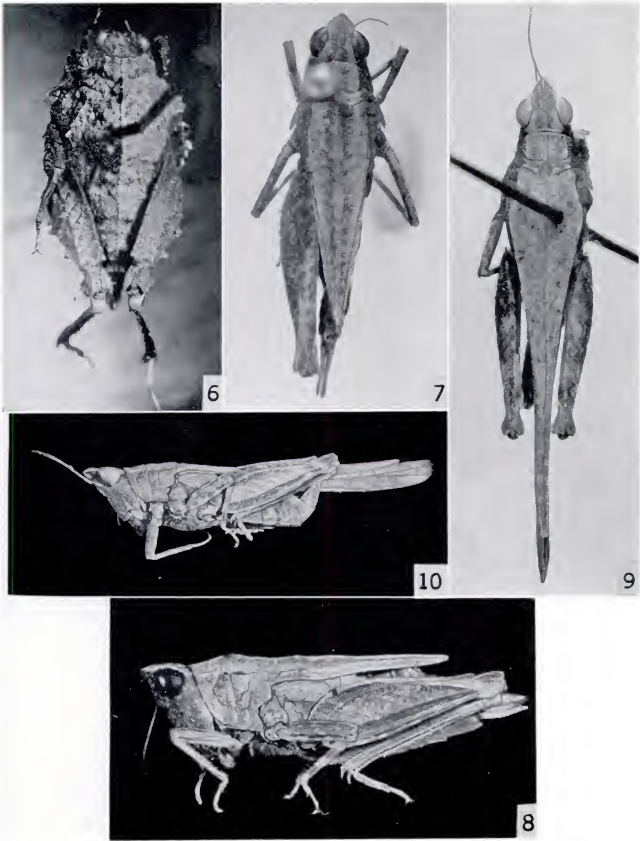
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